PRICE $2.00

HEATH COMPANY • BENTON HARBOR, MICHIGAN

HEATHKIT®
ASSEMBLY MANUAL

HEATHKIT

ELECTRONIC DESK-TOP CALCULATOR
MODEL IC-2008

Copyright © 1972
Heath Company
All rights reserved

595-1454

Dear Customer:

You have just purchased one of the best performing electronic products in the world — your Heathkit.

Here's how we aim to keep it that way:

Your Heathkit Warranty

During your first 90 days of ownership, any parts which we find are defective, either in materials or workmanship, will be replaced or repaired free of charge. And we'll pay shipping charges to get those parts to you — anywhere in the world.

If we determine a defective part has caused your Heathkit to need other repair, through no fault of yours, we will service it free — at the factory, at any retail Heathkit Electronic Center, or through any of our authorized overseas distributors.

This protection is exclusively yours as the original purchaser. Naturally, it doesn't cover damage by use of acid-core solder, incorrect assembly, misuse, fire, flood or acts of God. But, it does insure the performance of your Heathkit anywhere in the world — for most any other reason.

After-Warranty Service

What happens after warranty? We won't let you down. If your Heathkit needs repairs or you need a part, just write or call the factory, your nearest retail Heathkit Electronic Center, or any Heath authorized overseas distributor. We maintain an inventory of replacement parts for each Heathkit model at most locations — even for models that no longer appear in our current product line-up. Repair service and technical consultation is available through all locations.

We hope you'll never need our repair or replacement services, but it's nice to know you're protected anyway — and that cheerful help is nearby.

Sincerely,

HEATH COMPANY
Benton Harbor, Michigan 49022

Assembly and Operation of the

HEATHKIT®

ELECTRONIC DESK-TOP CALCULATOR

MODEL IC-2008

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

TABLE OF CONTENTS

INTRODUCTION 3

ASSEMBLY NOTES 5

PARTS LIST 7

STEP-BY-STEP ASSEMBLY
- Readout Circuit Board 10
- Main Circuit Board 13
- Final Assembly 23
- Tester Assembly 30

TEST 35

CABINET ASSEMBLY 37

OPERATION 41

IN CASE OF DIFFICULTY 51
- Troubleshooting Chart 53
- Factory Repair Service 54

SPECIFICATIONS 55

CIRCUIT FUNDAMENTALS 57

CIRCUIT BOARD X-RAY VIEWS 61

VOLTAGE CHARTS 65

IDENTIFICATION PHOTOGRAPH 69

SCHEMATIC. . .(fold-out from page) 71

INTRODUCTION

The Heathkit Model IC-2008 Electronic Desk-Top Calculator adds, subtracts, multiplies, and divides with speed, accuracy, and convenience. Several features of the Calculator are: a constant number function, a large-scale integrated circuit, and an 8-digit, easy-to-read display.

A constant number (K) can be entered into the Calculator to speed up repetitive calculations in multiplication and division. By sequencing the basic functions of the Calculator and using a constant (K), you can quickly complete complex mathematical calculations that otherwise would be very lengthy, tedious operations.

A sophisticated integrated circuit (IC) is the heart of the all-solid-state circuit. This MOS/LSI* device performs all of the mathematical operations of the Calculator, making this one of the first low-priced instruments to take advantage of the advanced technology provided by this device.

The 8-digit readout allows you to handle practically all numbers commonly encountered. You can select the location of the decimal point in the answer, or allow it to be placed automatically in the correct location for each calculation.

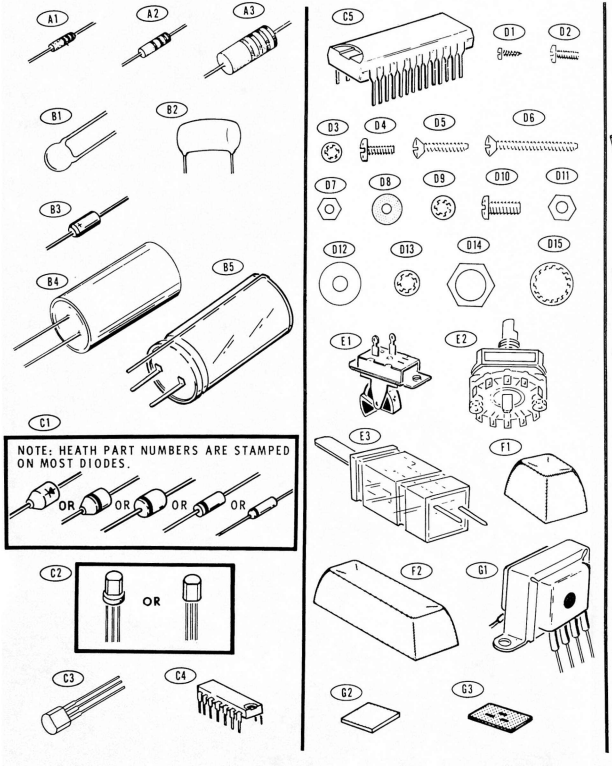
Readout tubes clearly display the numbers on a sloped surface to reduce glare. The standard keyboard arrangement provides for ease of operation and makes it easy for you to switch over from a standard adding machine keyboard to the Calculator.

The attractive, modern styling and small size of the Calculator make it ideally suited for use almost anywhere. Whether you use the Calculator in business or for personal applications, you will find it to be a useful tool in your everyday calculations.

Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

*MOS (Metal Oxide Semiconductor)/LSI (Large Scale Integration).

PARTS PICTORIAL



ASSEMBLY NOTES

1. Before you start to assemble this kit, read the wiring, soldering, and step-by-step assembly information in the "Kit Builders Guide."

2. Due to the small foil area around the circuit board holes and the small areas between foils, it will be necessary to use the utmost care to prevent solder bridges between adjacent foil areas. Use only a minimum amount of solder and do not heat components excessively with the soldering iron. Use no larger than a 25-watt soldering iron with a small tip. Allow it to reach operating temperature, and then apply it only long enough to make a good solder connection.

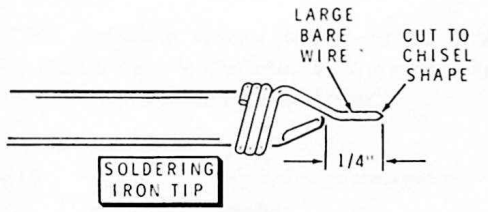


Figure A

3. If a small wattage, small-tip soldering iron is not available, proceed as follows: Be sure your soldering iron is cool. Wrap the large bare wire (supplied) tightly around the soldering iron tip as shown in Figure A. Allow approximately 1/4" of wire to extend beyond the end of the soldering iron. Cut the wire end to a chisel shape as shown. Occasionally apply solder to the turns of large bare wire to achieve a good heat transfer.

4. Resistors will be called out by their resistance value in Ω, kΩ, or MΩ, and color code. Use 1/4-watt resistors unless directed otherwise.

5. Capacitors will be called out by their capacitance value (in pF or μF) and type (disc, mica, Mylar*, or electrolytic).

6. The circuit board has foil on both sides of the board. Components will be installed on the lettered (side with the component outlines) side, and the leads will be soldered to the foil on the other side. Never make a solder connection on the component side of the circuit board unless specifically instructed to do so. Due to the nature of the board, solder may be drawn through a circuit board hole to the lettered side. This is normal. However, do not allow solder to flow into unused holes when soldering components to the foil.

*Dupont Registered Trademark

PARTS LIST

Check each part against the following list. The key numbers correspond to the numbers in the Parts Pictorial (fold-out from Page 4). Any part that is packaged in an individual envelope with the part number on it should be placed back in the envelope after it is identified until it is called for in a step.

CAUTION: The large integrated circuit (#443-88) can be damaged by static voltage. Do not handle it until you are told to do so.

To order replacement parts: Use the Parts Order Form furnished with this kit. If one is not available, see "Replacement Parts" in the "Kit Builders Guide."

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
RESISTORS				
NOTE: The following resistor tolerances are 10% unless otherwise noted. 10% is indicated by a fourth color band silver, while 5% is indicated by a gold band.				
1/4-Watt				
A1	1-56-12	2	15 Ω, 5% (brown-green-black)	.10
A1	1-37-12	1	150 Ω (brown-green-brown)	.10
A1	1-3-12	9	1200 Ω (brown-red-red)	.10
A1	1-36-12	1	1500 Ω (brown-green-red)	.10
A1	1-72-12	2	2200 Ω, 5% (red-red-red)	.10
A1	1-7-12	2	3900 Ω (orange-white-red)	.10
A1	1-8-12	19	4700 Ω (yellow-violet-red)	.10

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
Resistors (cont'd.)				
A1	1-77-12	5	5600 Ω, 5% (green-blue-red)	.10
A1	1-9-12	20	10 kΩ (brown-black-orange)	.10
A1	1-14-12	2	12 kΩ (brown-red-orange)	.10
A1	1-10-12	5	15 kΩ (brown-green-orange)	.10
A1	1-45-12	1	22 kΩ (red-red-orange)	.10
A1	1-32-12	9	100 kΩ (brown-black-yellow)	.10
A1	1-38-12	9	220 kΩ (red-red-yellow)	.10
A1	1-18-12	8	470 kΩ (yellow-violet-yellow)	.10

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
1/2-Watt				
A2	1-45	1	220 Ω (red-red-brown)	.10
A2	1-58	1	22 kΩ, 5% (red-red-orange)	.10
A2	1-115	2	47 kΩ, 5% (yellow-violet-orange)	.10
A2	1-65	1	51 kΩ, 5% (green-brown-orange)	.10
Other Resistors				
A3	1-25-2	1	43 Ω, 5%, 2-watt (yellow-orange-black)	.30
CAPACITORS				
B1	21-56	2	470 pF disc	.10
B1	21-14	1	.001 μF disc	.10
B2	27-62	1	.68 μF Mylar	.60
B3	25-211	1	33 μF electrolytic	.85
B4	25-164	1	1000 μF electrolytic	1.20
B5	25-270	1	Dual 20 μF electrolytic	1.20
DIODES-TRANSISTORS-INTEGRATED CIRCUITS				
C1	56-97	2	1N3017 zener diode, 7.5V, 34 mA	.35
C1	57-27	4	1N2071 silicon diode, 1A, 600V	.50
C1	57-65	1	1N4002 silicon diode, 1A, 100V	.20

NOTE: Transistors and integrated circuits are marked for identification in one of the following four ways:

1. Part number.
2. Type number. (In integrated circuits this refers only to the numbers; the letters may vary.)
3. Part number and type number.
4. Part number with a type number other than the one listed.

C2	417-118	5	2N3393 transistor	.40
C2	417-201	1	X29A829 transistor	.50
C3	417-294	19	MPS-A42 transistor	.60
C3	417-295	9	MPS-L51 transistor	.50
C4	443-4	1	SN7472N integrated circuit	.90
C5	443-88	1	TMS1875 integrated circuit	35.00

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
HARDWARE				
#2 Hardware				
D1	250-420	3	2-32 x 1/4" self-tapping screw	.05
#4 Hardware				
D2	250-52	2	4-40 x 1/4" screw	.05
D3	254-34	2	#4 lockwasher	.05
#6 Hardware				
D4	250-587	13	6-32 x 5/16" screw	.05
D5	250-559	2	6-20 x 5/8" self-tapping screw	.05
D6	250-1137	2	6-20 x 1-1/8" self-tapping screw	.10
D7	252-3	9	6-32 nut	.05
D8	253-1	2	#6 fiber flat washer	.05
D9	254-1	14	#6 lockwasher	.05
#8 Hardware				
D10	250-137	2	8-32 x 3/8" screw	.05
D11	252-4	2	8-32 nut	.05
D12	253-45	2	#8 flat washer	.05
D13	254-2	4	#8 lockwasher	.05
Control Hardware				
D14	252-7	1	Control nut	.05
D15	254-5	1	Control lockwasher	.05
SWITCHES				
E1	60-45	1	Rocker switch	.50
E2	63-655	1	Rotary switch	3.75

One set of keyboard switches (#64-606) consisting of:

E3	64-604	19	Non-latching switch	.65
E3	64-605	1	Latching switch (red actuator)	.65

SWITCH TOPS

One set of keyboard switch tops (#462-388) consisting of:

F1	462-380	1	÷ key top	.40
F1	462-381	1	+/– key top	.40
F1	462-382	1	K key top	.40
F1	462-383	1	C key top	.40

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
Switch Tops (cont'd.)				
F1	462-384	1	C_D key top	.40
F1	462-378	1	• key top	.40
F1	462-379	1	– key top	.40
F1	462-368	1	1 key top	.40
F1	462-369	1	2 key top	.40
F1	462-370	1	3 key top	.40
F1	462-371	1	4 key top	.40
F1	462-372	1	5 key top	.40
F1	462-373	1	6 key top	.40
F1	462-374	1	7 key top	.40
F1	462-375	1	8 key top	.40
F1	462-376	1	9 key top	.40
F2	462-377	1	0 key top	.40
F2	462-385	1	+ key top	.40
F2	462-386	1	x key top	.40
F2	462-387	1	= key top	.40
WIRE-SLEEVING				
	344-21	1	Red wire	.05/ft
	344-59	1	White wire	.05/ft
	340-11	1	Large bare wire (used only for soldering iron tip)	.05/ft
	89-26	1	Line cord	.55
	346-2	1	Sleeving	.05/ft
MISCELLANEOUS				
G1	54-810	1	Power transformer	4.80
G2	75-138	4	Rubber foot	.10
G3	75-165	1	Switch insulator	.10
	85-1192-1	1	Main circuit board	7.00
	85-1252-1	1	Readout circuit board	2.90
G4	92-71	1	Cabinet top	1.25
G5	92-72	1	Cabinet bottom	2.45
G6	204-1853-1	1	Switch bracket	1.20
G7	204-1854	2	Circuit board bracket	.10
G8	205-141	2	Tool plate	.10

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
Miscellaneous (cont'd.)				
G9	258-167	3	Window bracket	.05
G10	260-65	2	Fuse clip	.10
G11	260-16	1	Alligator clip	.10
G12	266-272	1	Number drum	.25
G13	462-224	1	Thumbwheel knob	.25
G14	411-281	3	Display tube (3-digit)	7.35
G15	412-11	1	Neon lamp	.20
G16	421-26	1	1/8-ampere slow-blow fuse	.30
G17	431-62	1	Terminal strip	.10
G18	432-144	56	Connector	.01
G19	434-227	3	Socket	2.70
G20	446-603	1	Window	.90
G21	490-5	1	Nut starter	.10
G22	490-111	1	IC puller	.10
	390-362	1	Fuse label	.10
	390-967	1	Number label	.25
	390-968	1	Power requirements label	.10
	391-34	1	Blue and white label	
	597-260	1	Parts Order Form	
	597-308	1	Kit Builders Guide	
			Manual (See front cover for part number.)	2.00
			Solder (Additional 3' rolls of solder can be ordered under part number 331-6 for $ .15 each.)	

The above prices apply only on purchases from the Heath Company where shipment is to a U.S.A. destination. Add 10% (minimum 25 cents) to the price when ordering from a Heathkit Electronic Center to cover local sales tax, postage, and handling. Outside the U.S.A., parts and service are available from your local Heathkit source and will reflect additional transportation, taxes, duties, and rates of exchange.

STEP-BY-STEP ASSEMBLY

READOUT CIRCUIT BOARD

START

NOTE: Be sure you have read the "Assembly Notes" (Page 5) before you perform the following steps.

Position the readout circuit board lettered-side-up as shown. Then complete each step on the following Pictorials.

( ) 10 kΩ (brown-black-orange).

( ) 4700 Ω (yellow-violet-red).

( ) 10 kΩ (brown-black-orange).

( ) 4700 Ω (yellow-violet-red).

( ) 10 kΩ (brown-black-orange).

( ) 4700 Ω (yellow-violet-red).

( ) 10 kΩ (brown-black-orange).

( ) 4700 Ω (yellow-violet-red).

( ) Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.

( ) 4700 Ω (yellow-violet-red).

( ) 10 kΩ (brown-black-orange).

( ) 4700 Ω (yellow-violet-red).

( ) 10 kΩ (brown-black-orange).

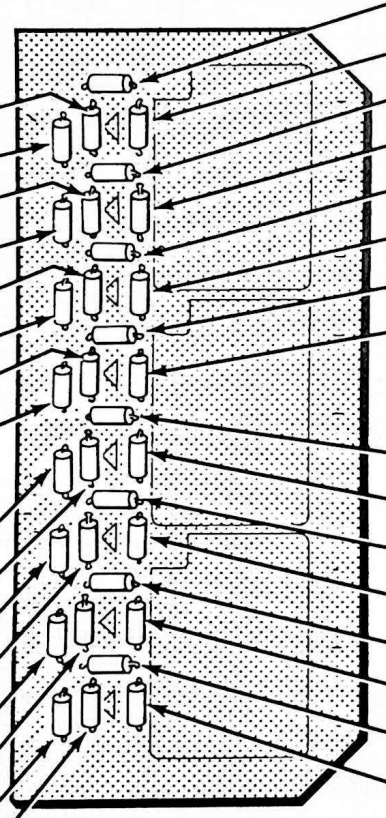
( ) 4700 Ω (yellow-violet-red).

( ) 10 kΩ (brown-black-orange).

( ) Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.

FOR GOOD SOLDERED CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN...

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



CONTINUE

( ) 470 kΩ (yellow-violet-yellow).

( ) 15 kΩ (brown-green-orange).

( ) 470 kΩ (yellow-violet-yellow).

( ) 15 kΩ (brown-green-orange).

( ) 470 kΩ (yellow-violet-yellow).

( ) 12 kΩ (brown-red-orange).

( ) 470 kΩ (yellow-violet-yellow).

( ) 15 kΩ (brown-green-orange).

( ) Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.

( ) 470 kΩ (yellow-violet-yellow).

( ) 12 kΩ (brown-red-orange).

( ) 470 kΩ (yellow-violet-yellow).

( ) 15 kΩ (brown-green-orange).

( ) 470 kΩ (yellow-violet-yellow).

( ) 15 kΩ (brown-green-orange).

( ) 470 kΩ (yellow-violet-yellow).

( ) 22 kΩ (red-red-orange).

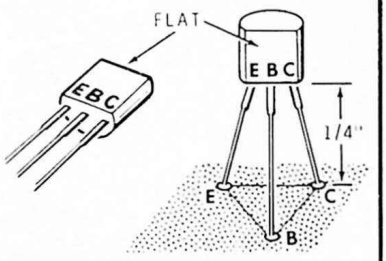
( ) Turn the circuit board over, solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 1-1

START

NOTE: In the following steps, install each of the transistors as follows:

1. Refer to the illustration below and identify the E, B, and C leads of the transistor.
2. Insert the transistor leads into the corresponding E, B, and C holes in the circuit board.
3. Position the transistor 1/4" above the circuit board.
4. Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.



( ) MPS-A42 transistor (#417-294) at Q101.

( ) MPS-A42 transistor (#417-294) at Q102.

( ) MPS-A42 transistor (#417-294) at Q103.

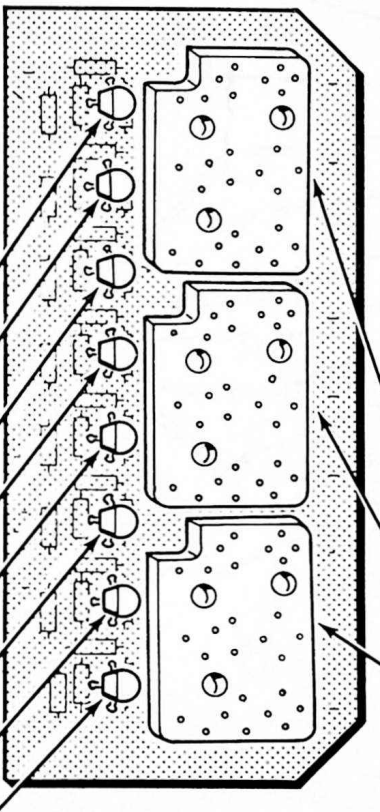
( ) MPS-A42 transistor (#417-294) at Q104.

( ) MPS-A42 transistor (#417-294) at Q105.

( ) MPS-A42 transistor (#417-294) at Q106.

( ) MPS-A42 transistor (#417-294) at Q107.

( ) MPS-A42 transistor (#417-294) at Q108.



CONTINUE

NOTE: In the following steps, install each socket as follows:

1. Examine the socket carefully. Each socket must have 27 pins. Once the socket has been soldered to the circuit board, it is difficult to remove or replace.
2. Align the socket with the outline on the circuit board as you mount the socket.
3. Be sure the socket is seated against the circuit board; then turn the circuit board over and solder one pin at each end of the socket.
4. Re-examine the socket to make sure it is still seated against the circuit board. Then solder the remaining pins.

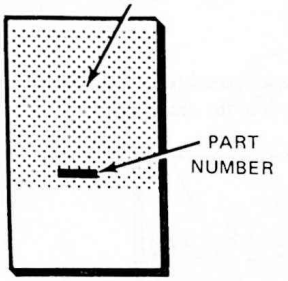
(✓) Socket at V101.

(✓) Socket at V102.

( ) Socket at V103.

PICTORIAL 1-2

The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION DRAWING

START

( ) 220 Ω, 1/2-watt (red-red-brown).

( ) 22 kΩ, 1/2-watt (red-red-orange).

( ) 51 kΩ, 1/2-watt (green-brown-orange).

( ) 47 kΩ, 1/2-watt (yellow-violet-orange).

( ) 10 kΩ (brown-black-orange).

( ) 3900 Ω (orange-white-red).

( ) 3900 Ω (orange-white-red).

( ) 10 kΩ (brown-black-orange).

( ) 10 kΩ (brown-black-orange).

( ) 150 Ω (brown-green-brown).

( ) Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.

( ) 2200 Ω (red-red-red).

( ) 2200 Ω (red-red-red).

( ) 5600 Ω (green-blue-red).

( ) 5600 Ω (green-blue-red).

( ) 5600 Ω (green-blue-red).

( ) 5600 Ω (green-blue-red).

( ) 5600 Ω (green-blue-red).

( ) 1500 Ω (brown-green-red).

( ) 15 Ω (brown-green-black).

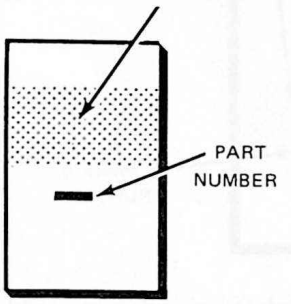
( ) 15 Ω (brown-green-black).

( ) Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.

You should have a 47 kΩ, 1/2-watt (yellow-violet-orange) resistor left. Set it aside; it will be used later.

PICTORIAL 2-2

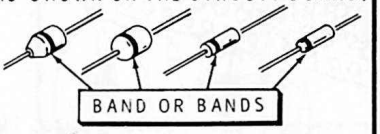
The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION DRAWING

START

NOTE: DIODES MAY BE SUPPLIED IN ANY OF THE FOLLOWING SHAPES. ALWAYS POSITION THE BANDED END AS SHOWN ON THE CIRCUIT BOARD.



( ) 1N2071 silicon diode (#57-27) at D7.

( ) 1N2071 silicon diode (#57-27) at D6.

( ) 1N2071 silicon diode (#57-27) at D5.

( ) 1N2071 silicon diode (#57-27) at D4.

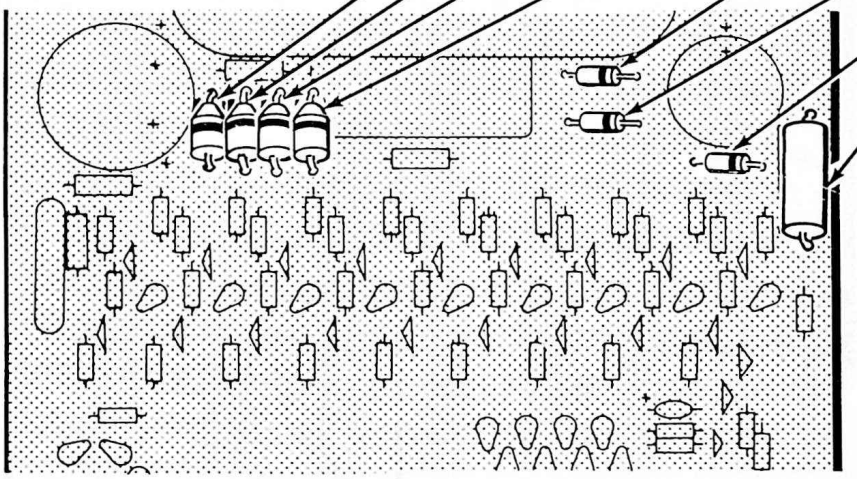
( ) 1N4002 silicon diode (#57-65) at D1.

( ) 1N3017 zener diode (#56-97) at D2.

( ) 1N3017 zener diode (#56-97) at D3.

( ) 43 Ω, 2-watt (yellow-orange-black).

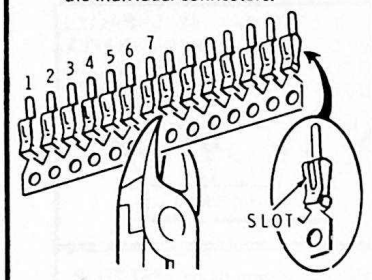
( ) Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.



PICTORIAL 2-3

START

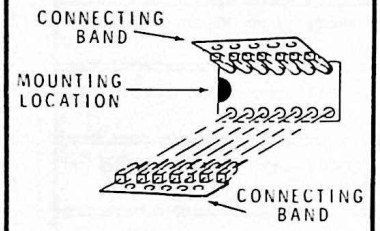
( ) Use the scale at the bottom of the page and cut off two (2) strips of seven connectors. Do not remove the individual connectors.



( ) Use the scale at the bottom of the page and cut off two strips of fourteen connectors.

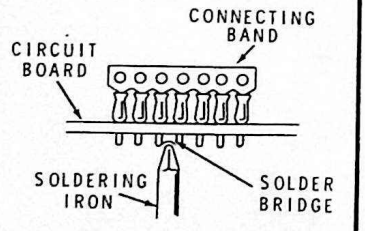
IMPORTANT: Use the following method to install the strips of connectors.

A. Position each strip with its connecting band toward the outside as shown.

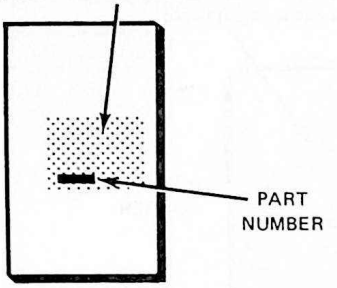


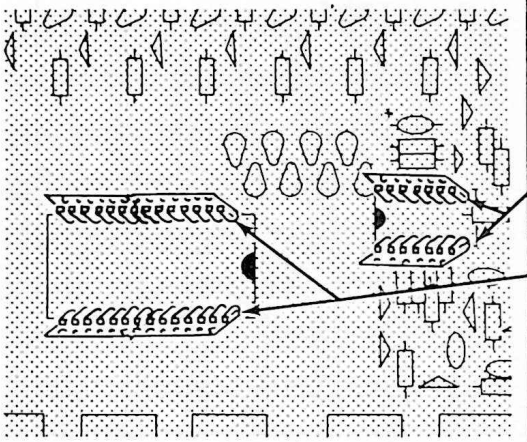
B. Be sure each strip of connectors is perpendicular to the circuit board. Then turn the circuit board over and solder the connectors to the foil. NOTE: It is easier to solder the connectors to the foil if you use a small-tip soldering iron. If one is not available, refer to Assembly Note #3 on Page 5.

C. If a solder bridge occurs, clean the soldering iron tip and place it between the two points that are bridged until the excess solder flows down the tip.



The steps performed in this Pictorial are in this area of the circuit board.





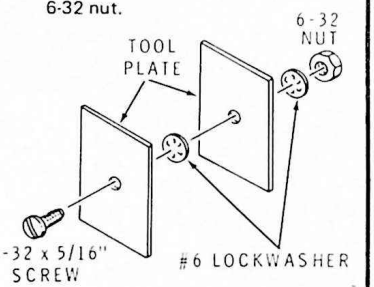
CONTINUE

NOTE: Before you install connectors in the following steps, be sure the circuit board holes are not filled with solder. If necessary, heat the foil and use a length of bare wire (or a component lead) to clear the hole.

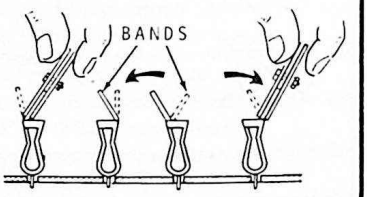
( ) Two strips of seven connectors at IC2.

( ) Two strips of fourteen connectors at IC1.

( ) Assemble the two tool plates together as shown. Use a 6-32 x 5/16" screw, two #6 lockwashers, and a 6-32 nut.



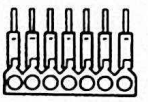
( ) Use the assembled tool plates to remove the connecting bands. First bend each band inward, and then outward, as shown (several times if necessary). Do not bend the connectors.



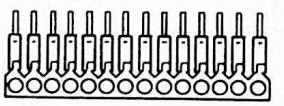
NOTE: The IC's (integrated circuits) will be installed later.

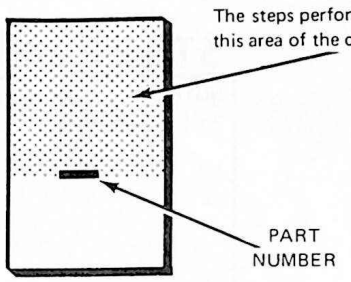
PICTORIAL 2-4

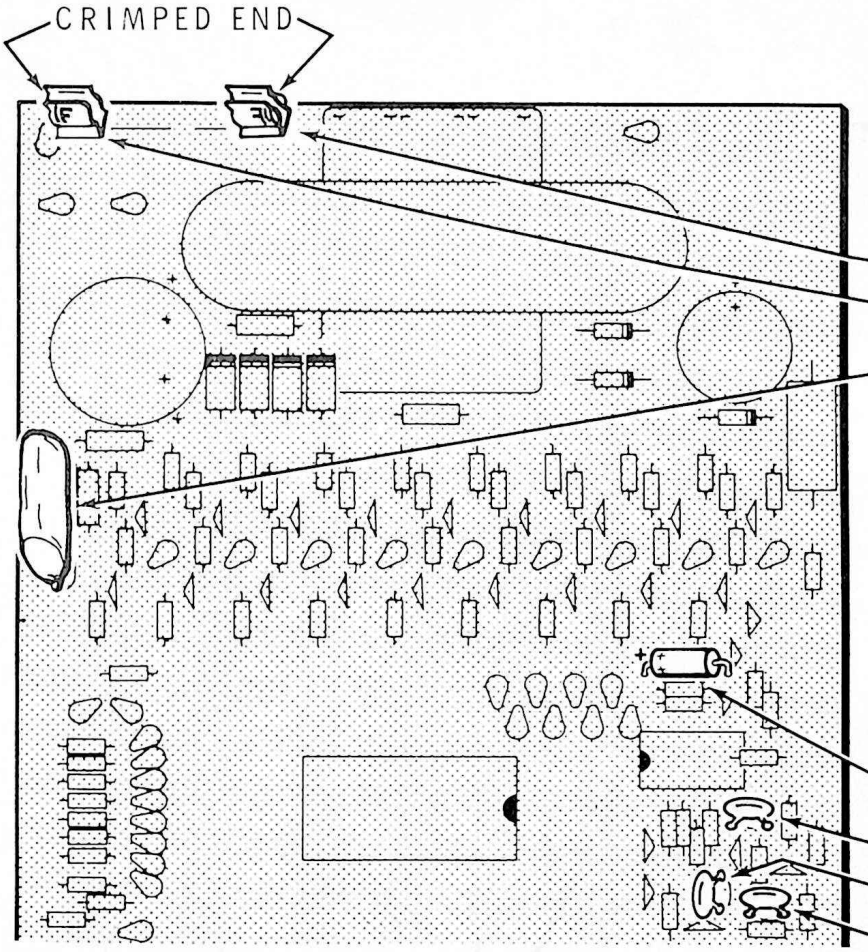
STRIP OF SEVEN CONNECTORS



STRIP OF FOURTEEN CONNECTORS







START

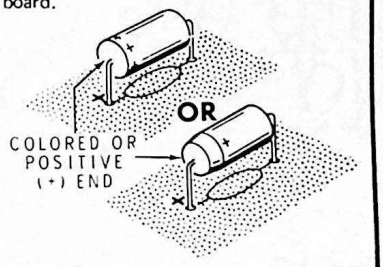
NOTE: When installing the fuse clips in the following steps, be sure to position the crimped end of the clips as shown. Turn the circuit board over and solder each clip to the foil as it is installed.

( ) Fuse clip.

( ) Fuse clip.

( ) .68 µF Mylar.

NOTE: When you install electrolytic capacitors, always match the colored or the positive (+) marked end of the capacitor with the positive (+) mark on the circuit board.



( ) 33 µF electrolytic.

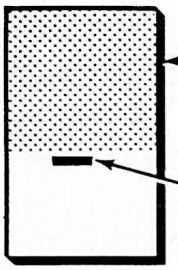
( ) 470 pF disc.

( ) .001 µF disc.

( ) 470 pF disc.

( ) Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.

PICTORIAL 2-5

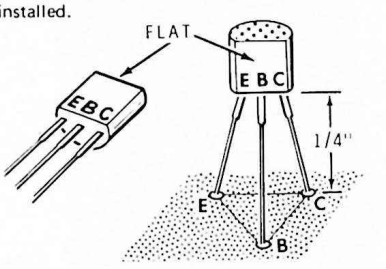


START

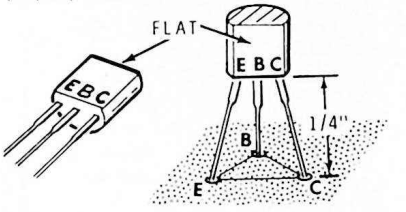
NOTE: In the following steps, install each of the transistors as follows:

1. Refer to the illustrations below and identify the E, B, and C leads of the transistor.
2. Bend the B lead of each transistor as directed in the step.
3. Insert the transistor leads into the corresponding E, B, and C holes in the circuit board.
4. Position the transistor 1/4" above the circuit board.
5. Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.

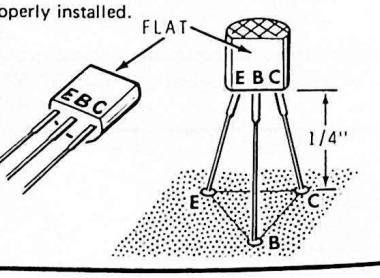
( ) Nine MPS-L51 transistors (#417-295) at Q1 through Q9. Bend the B (middle) lead of each transistor toward the flat. Notice that the flats are toward the left when these transistors are properly installed.

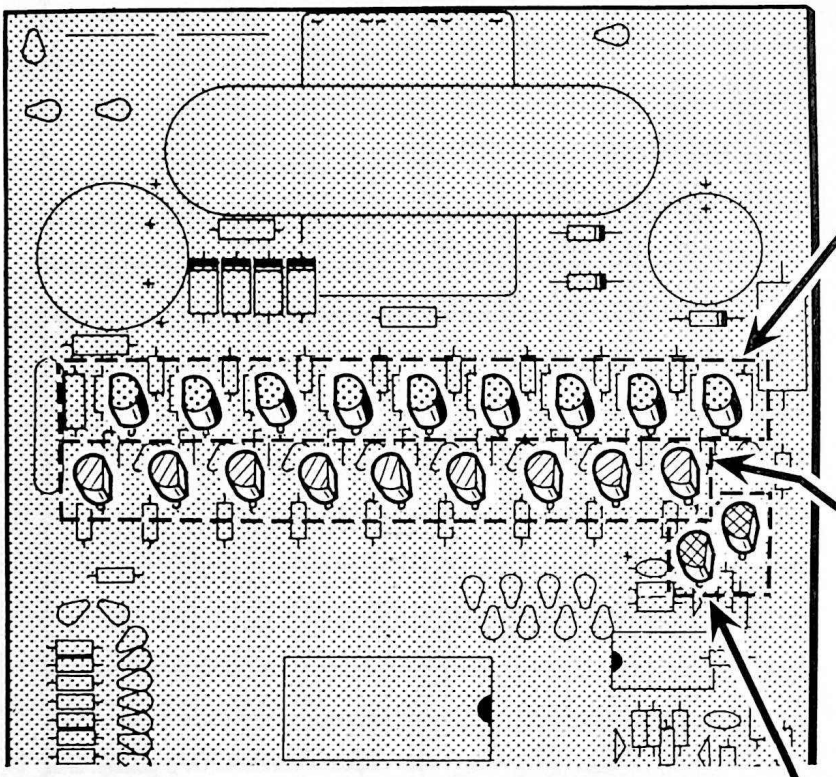


( ) Nine MPS-A42 transistors (#417-294) at Q10 through Q18. Bend the B (middle) lead of each transistor away from the flat. Notice that the flats are toward the right when these transistors are properly installed.



( ) Two MPS-A42 transistors (#417-294) at Q19 and Q20. Bend the B (middle) lead of each transistor toward the flat. Notice that the flats are also toward the right when these transistors are properly installed.

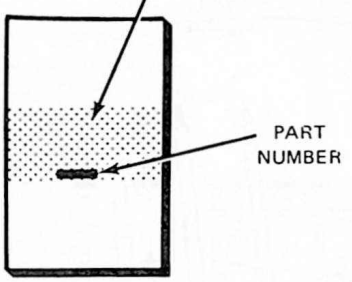




PICTORIAL 2-6

START

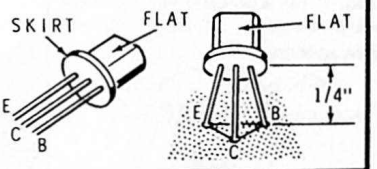
The steps performed in this Pictorial are in this area of the circuit board.



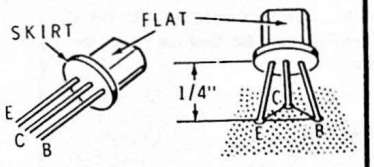
NOTE: In the following steps, install each of the transistors as follows:

1. Refer to the illustrations below and identify the E, C, and B leads of the transistor. The transistor supplied with your kit may not have a skirt as shown.
2. Bend the C lead of the transistor as directed in the step.
3. Insert the transistor leads into the corresponding E, C, and B holes in the circuit board.
4. Position the transistor 1/4" above the circuit board.
5. Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.

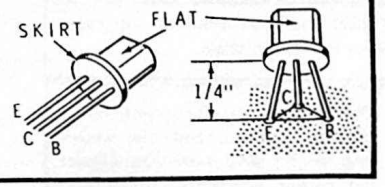
( ) 2N3393 transistors (#417-118) at Q21 and Q25. Bend the C (middle) lead of each transistor toward the flat.

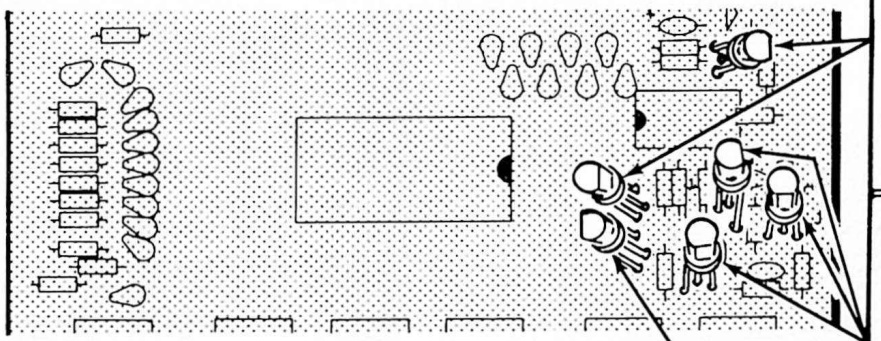


( ) 2N3393 transistors (#417-118) at Q22 through Q24. Bend the C (middle) lead of each transistor away from the flat.

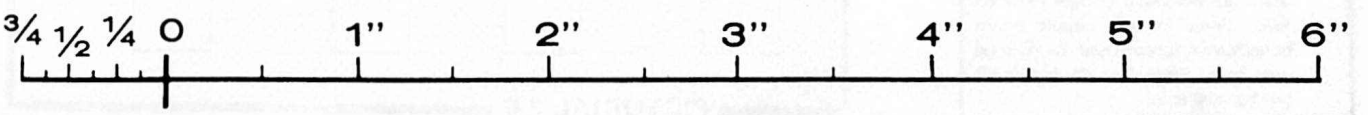


( ) X29A829 transistor (#417-201) at Q26. Bend the C (middle) lead of this transistor away from the flat.





PICTORIAL 2-7



START

NOTE: When wiring this kit, you will be instructed to prepare wires ahead of time, as in the next step. To prepare a wire, cut it to the indicated length and remove 1/4" of insulation from each end.

☐ Prepare the following wires:

nine	3" white
two	2-3/4" white
seven	2-1/4" white

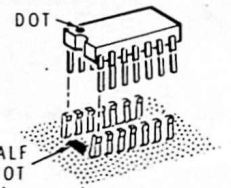
NOTE: The other end of each of the following wires will be connected later.

☐ Nine 3" white wires at holes 1 through 9.

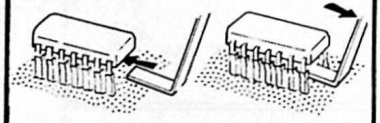
☐ Two 2-3/4" white wires at holes D8 and D0.

☐ Seven 2-1/4" white wires at holes D1 through D7.

NOTE: In the following step, position the notch or dot end of the IC over the dot screened on the circuit board. Then insert the IC leads into the IC connectors. Be sure each IC pin is properly inserted in the individual connector. DO NOT solder the IC to the connectors.



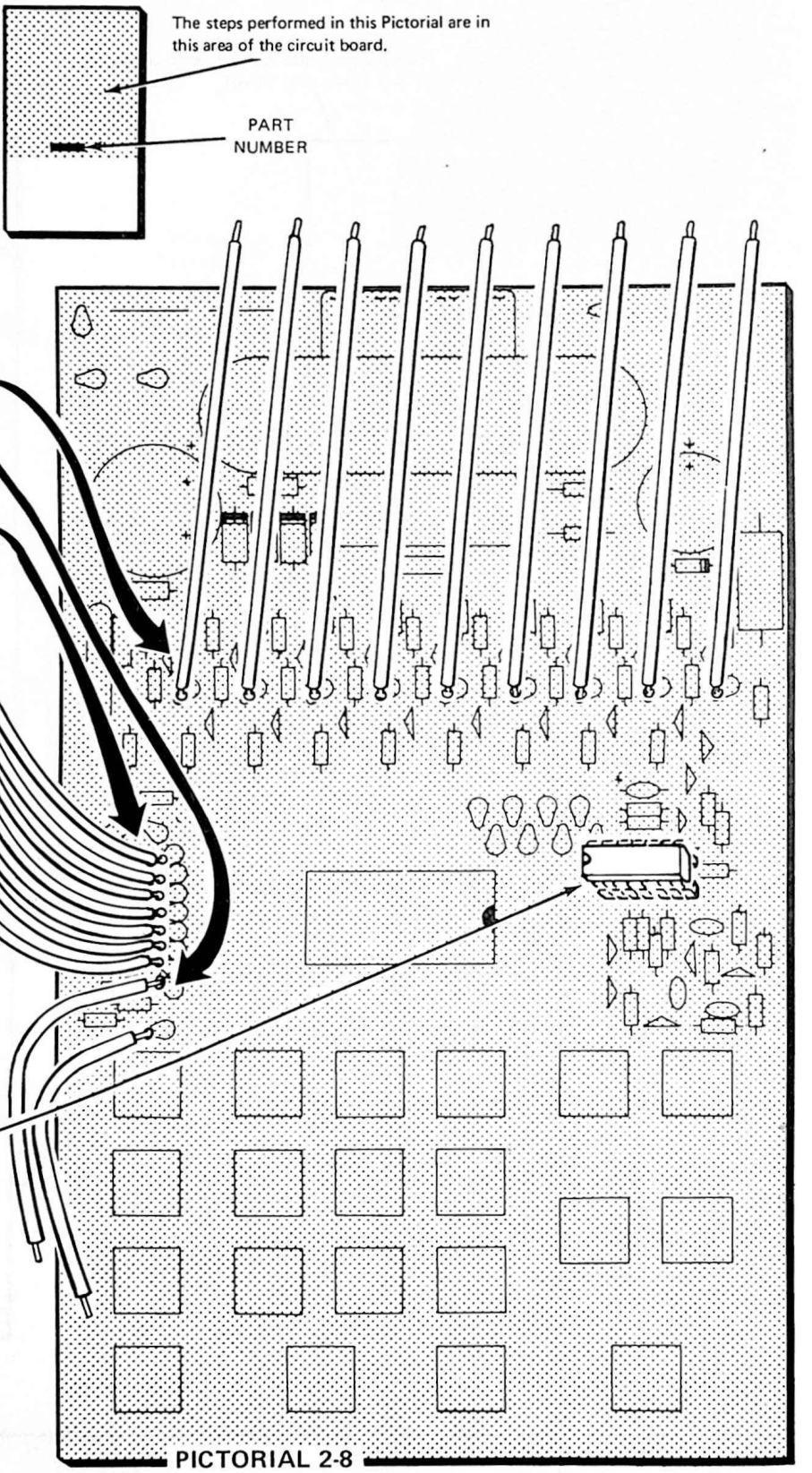
Should it ever become necessary to remove an IC from its connectors, use the IC puller supplied with your kit. To use the puller, insert its foot beneath the IC; then gently rock the tool back and forth to lift the IC.



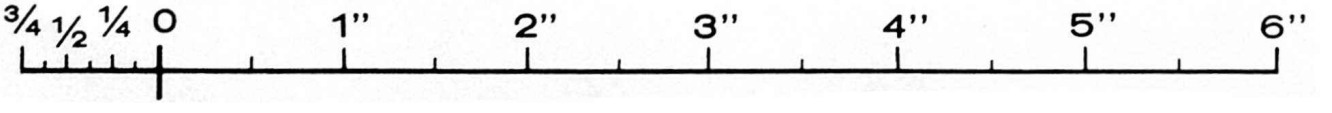
☐ SN7472N integrated circuit (#443-4) at IC2.

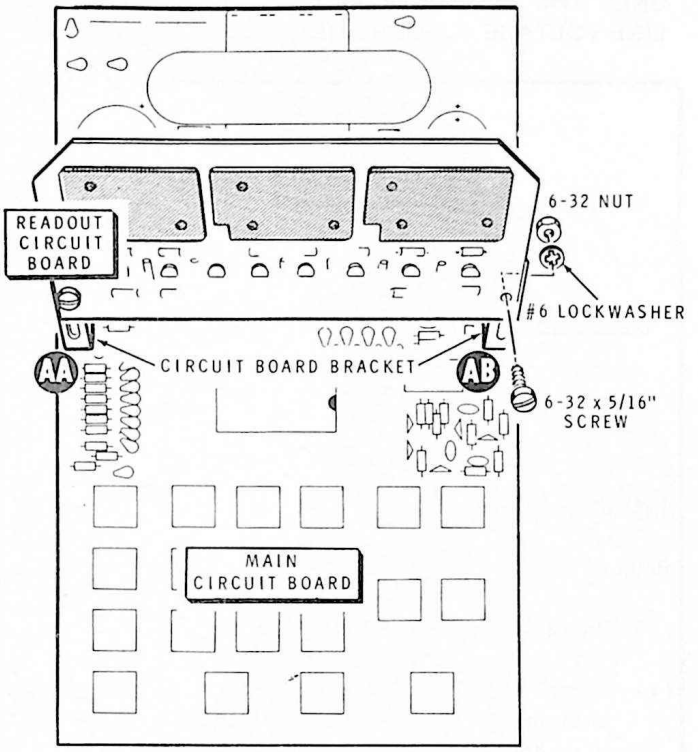
CAUTION: DO NOT install the integrated circuit at IC1 at this time.

☐ Check to see that all connections are properly soldered and that excess lead lengths are cut off. Also inspect the circuit board foil to be sure there are no solder bridges between foils. Some of the circuit board holes have not been used, but will be used later. Several of the holes will not be used at all.



PICTORIAL 2-8



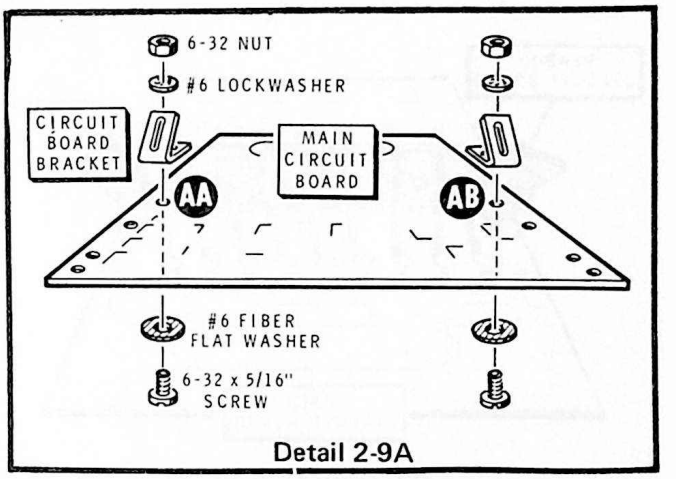


PICTORIAL 2-9

Refer to Pictorial 2-9 for the following steps.

NOTE: The term "hardware" refers to screws, nuts, and lockwashers when parts are being mounted in some of the following steps. The phrase "Use 6-32 x 5/16" hardware," for example, means to use a 6-32 x 5/16" screw, one or more #6 lockwashers, and a 6-32 nut. Refer to the Pictorial or Detail called out in the step for the correct number of lockwashers and the correct way to install the hardware.

( ) Refer to Detail 2-9A and install circuit board brackets at AA and AB on the main circuit board. Use a 6-32 x 5/16" screw, a #6 fiber flat washer, a #6 lockwasher, and a 6-32 nut at each location. NOTE: Be sure the #6 fiber washers are installed on the unlettered side of the circuit board.



Detail 2-9A

( ) Refer to Pictorial 2-9 and install the previously assembled readout circuit board on the circuit board brackets at AA and AB. Use 6-32 x 5/16" hardware. Position the readout circuit board with the hardware centered in the slots of the circuit board brackets. Then tighten the hardware.

Refer to Pictorial 2-10 (fold-out from Page 21) for the following steps.

In the following steps, connect the wires coming from the lettered holes in the readout circuit board to the correspondingly-lettered holes in the main circuit board.

( ) Hole K to hole K (S-1).

( ) Hole H to hole H (S-1).

( ) Hole A to hole A (S-1).

( ) Hole B to hole B (S-1).

( ) Hole C to hole C (S-1).

( ) Hole D to hole D (S-1).

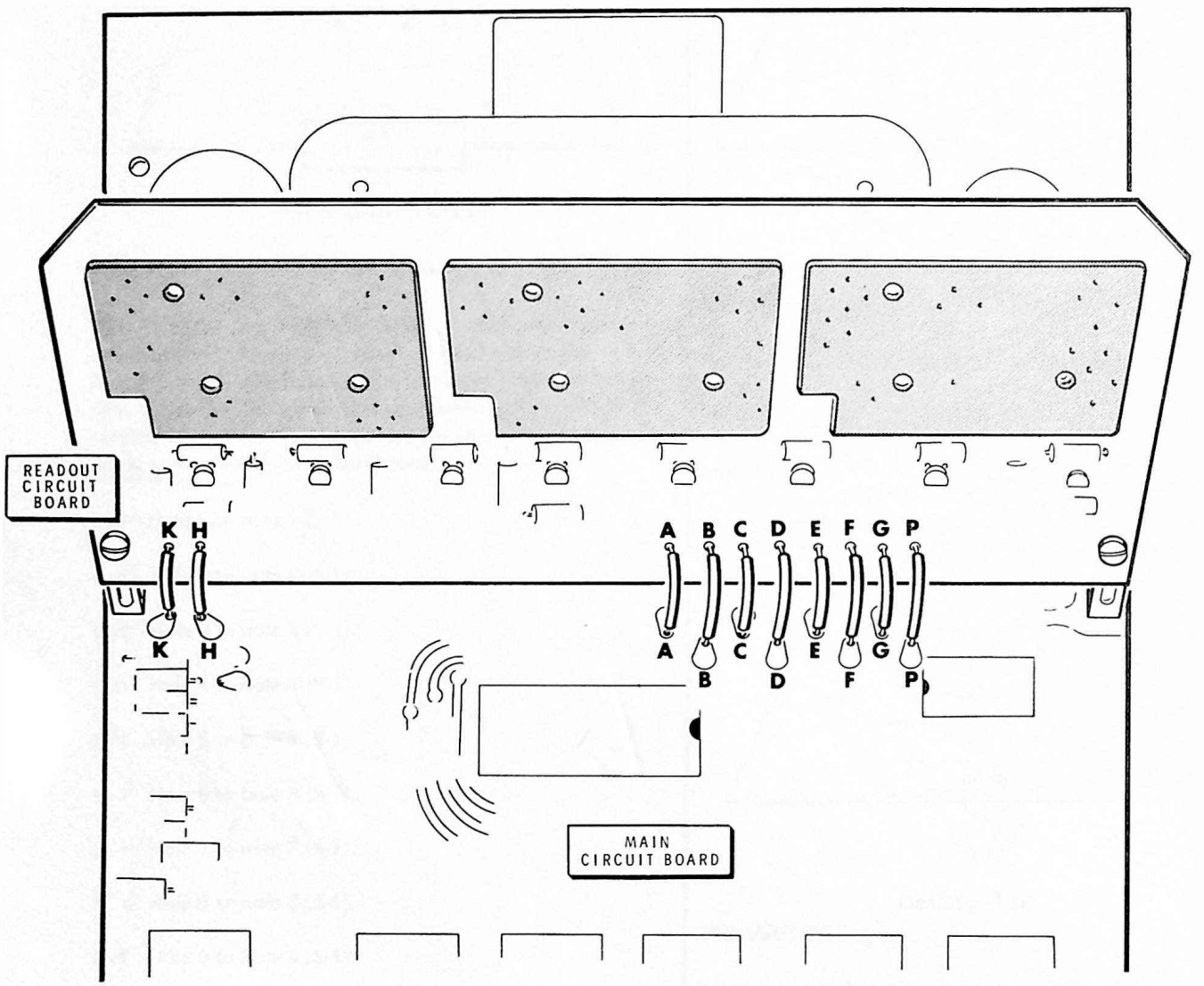
( ) Hole E to hole E (S-1).

( ) Hole F to hole F (S-1).

( ) Hole G to hole G (S-1).

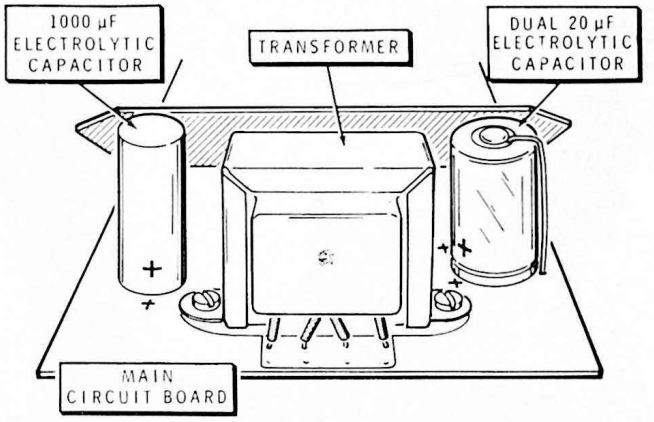
( ) Hole P to hole P (S-1).

( ) Cut off the excess lead lengths.



PICTORIAL 2-10

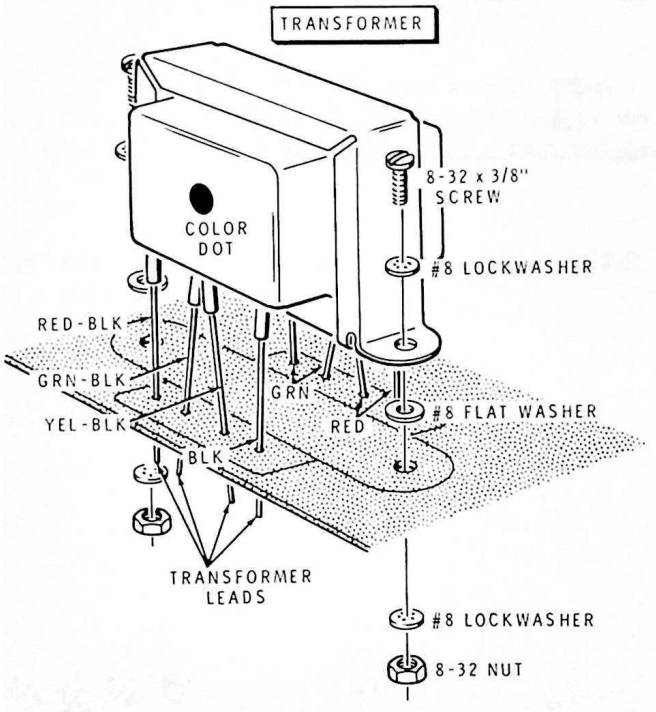
FINAL ASSEMBLY



PICTORIAL 2-12

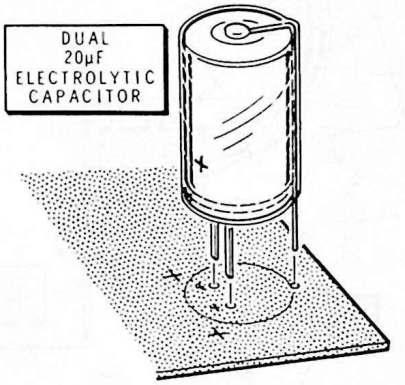
Refer to Pictorial 2-12 for the following steps.

( ) Refer to Detail 2-12A and install the transformer on the main circuit board. NOTE: Be sure to insert the transformer leads into the correct circuit board holes. When the transformer is correctly installed, the color dot will be as shown. Use 8-32 x 3/8" screws, #8 flat washers, #8 lockwashers, and 8-32 nuts. Then solder the leads to the foil and cut off the excess lead lengths.



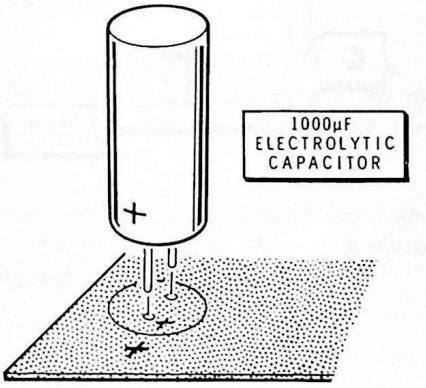
Detail 2-12A

NOTE: Throughout the remainder of the assembly, lift the circuit board by the transformer whenever you reposition or move the circuit board.



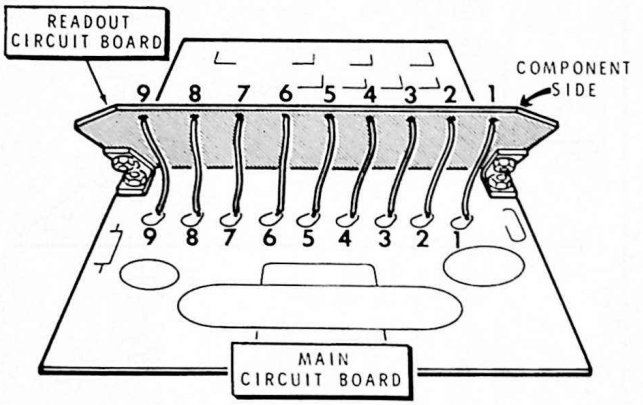
Detail 2-12B

( ) Refer to Detail 2-12B and install a dual 20 µF electrolytic capacitor on the main circuit board. Solder the leads to the foil and cut off the excess lead lengths.



Detail 2-12C

( ) Refer to Detail 2-12C and install a 1000 µF electrolytic capacitor on the main circuit board. Be sure to insert the positive (+) marked lead into the positive marked circuit board hole. Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 2-11

Refer to Pictorial 2-11 for the following steps.

NOTE: When you install the following nine wires, insert the wires coming from the numbered holes in the main circuit board into the correspondingly-numbered holes on the foil side (not the side with the component outlines) of the readout circuit board. Then solder the wire to the foil on the component side of the circuit board.

( ) Hole 1 to hole 1 (S-1).

( ) Hole 2 to hole 2 (S-1).

( ) Hole 3 to hole 3 (S-1).

( ) Hole 4 to hole 4 (S-1).

( ) Hole 5 to hole 5 (S-1).

( ) Hole 6 to hole 6 (S-1).

( ) Hole 7 to hole 7 (S-1).

( ) Hole 8 to hole 8 (S-1).

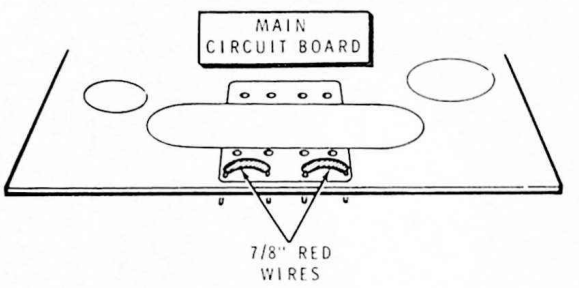
( ) Hole 9 to hole 9 (S-1).

( ) Cut off the excess lead lengths.

ALTERNATE LINE VOLTAGE WIRING

Two sets of line voltage wiring instructions are given below, one for 120 VAC line voltage and the other for 240 VAC line voltage. In the U.S.A. 120 VAC is most often used, while in foreign countries 240 VAC is most common. USE ONLY THE INSTRUCTIONS THAT AGREE WITH THE LINE VOLTAGE IN YOUR AREA.

120 VAC WIRING



Detail 2-11A

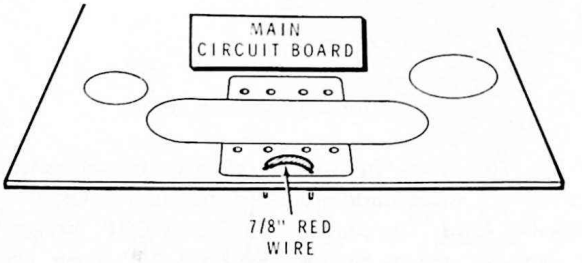
120 VAC Wiring

Refer to Detail 2-11A for the following two steps.

( ) Prepare two 7/8" lengths of red wire.

( ) Install two 7/8" red wires at the two 120 VAC locations on the circuit board. Then solder the wires to the foil and cut off the excess lead lengths.

240 VAC WIRING



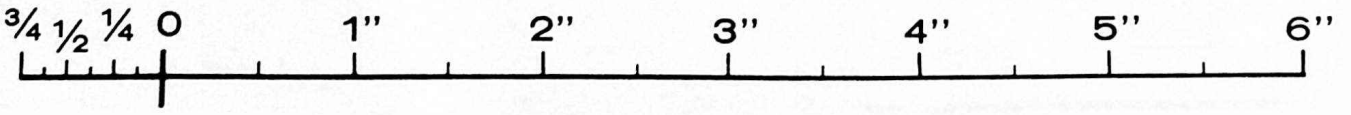
Detail 2-11B

240 VAC Wiring

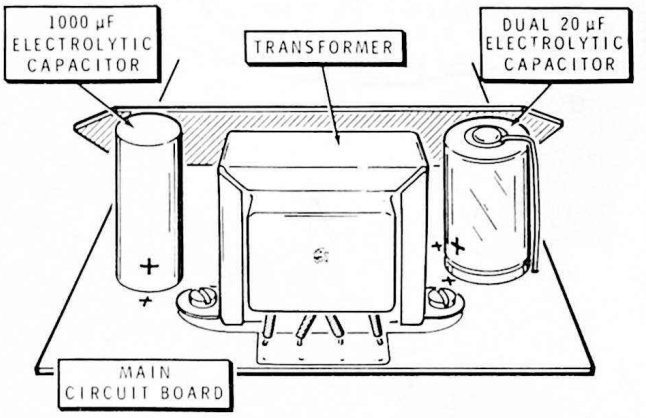
Refer to Detail 2-11B for the following two steps.

( ) Prepare a 7/8" length of red wire.

( ) Install a 7/8" red wire at the 240 VAC location on the circuit board. Then solder the wire to the foil and cut off the excess lead lengths.



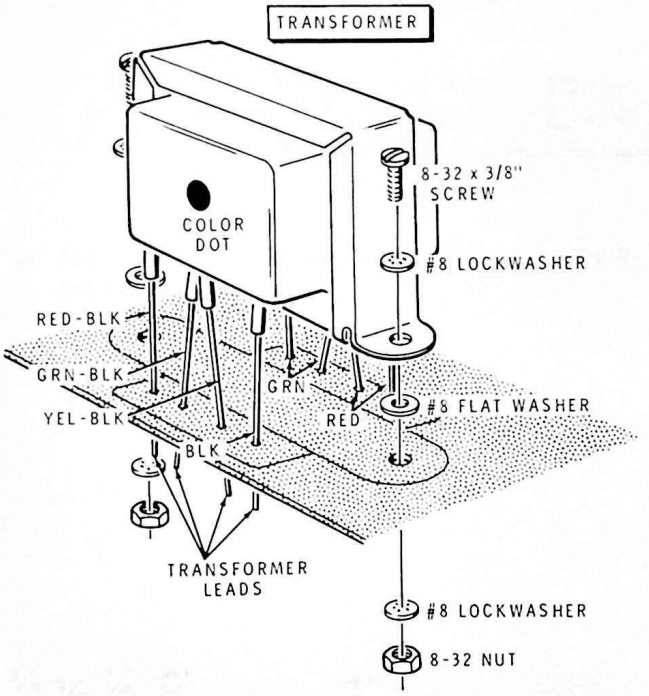
FINAL ASSEMBLY



PICTORIAL 2-12

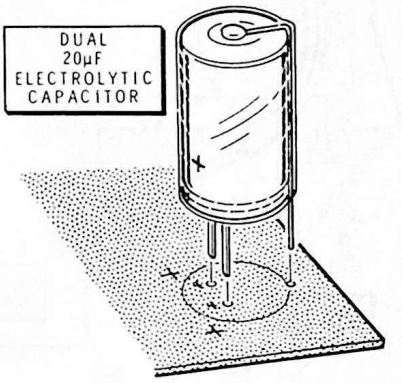
Refer to Pictorial 2-12 for the following steps.

( ) Refer to Detail 2-12A and install the transformer on the main circuit board. NOTE: Be sure to insert the transformer leads into the correct circuit board holes. When the transformer is correctly installed, the color dot will be as shown. Use 8-32 x 3/8" screws, #8 flat washers, #8 lockwashers, and 8-32 nuts. Then solder the leads to the foil and cut off the excess lead lengths.



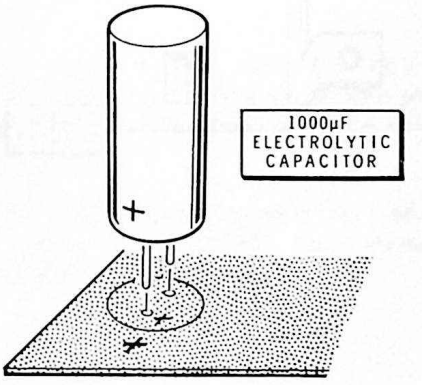
Detail 2-12A

NOTE: Throughout the remainder of the assembly, lift the circuit board by the transformer whenever you reposition or move the circuit board.



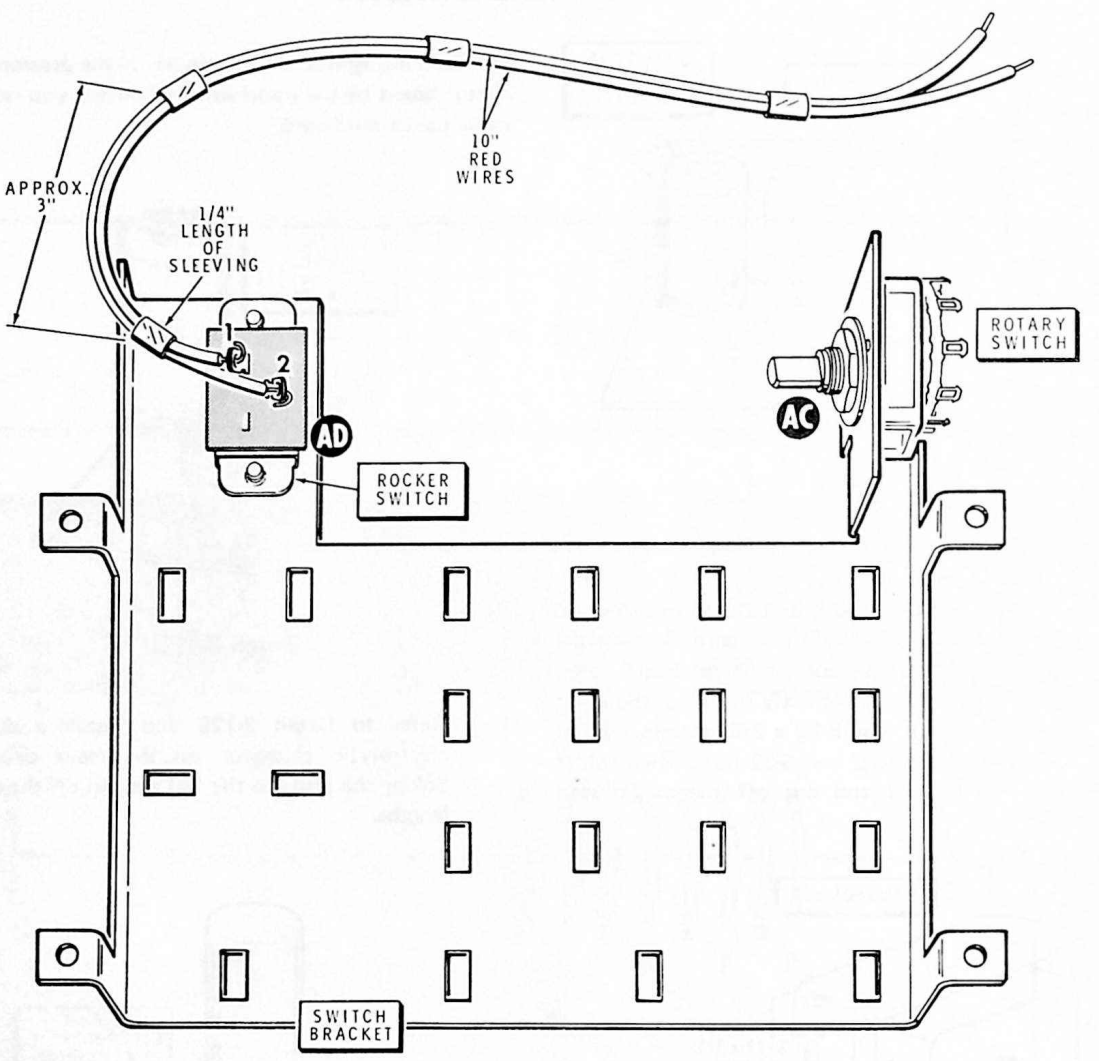
Detail 2-12B

( ) Refer to Detail 2-12B and install a dual 20 µF electrolytic capacitor on the main circuit board. Solder the leads to the foil and cut off the excess lead lengths.

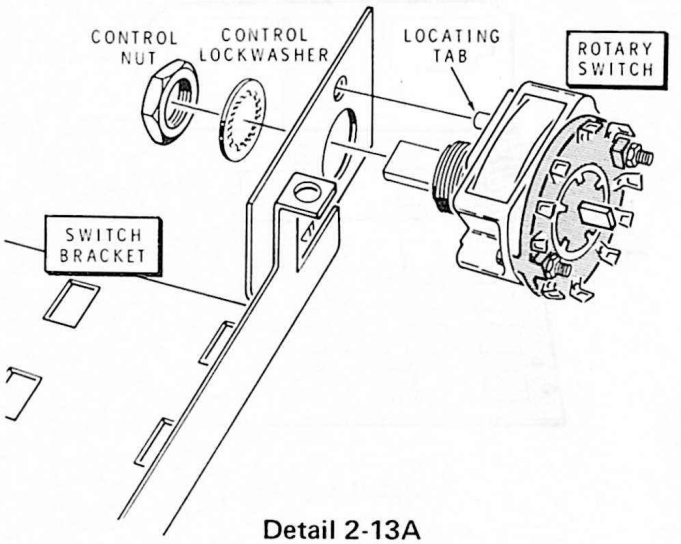


Detail 2-12C

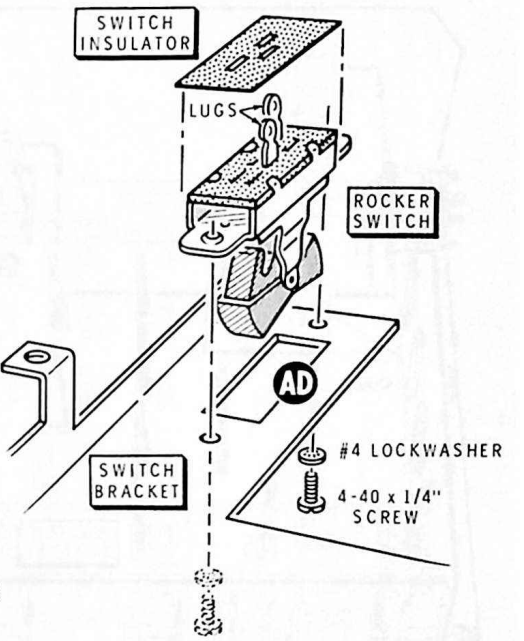
( ) Refer to Detail 2-12C and install a 1000 µF electrolytic capacitor on the main circuit board. Be sure to insert the positive (+) marked lead into the positive marked circuit board hole. Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 2-13



Detail 2-13A



Detail 2-13B

Refer to Pictorial 2-13 for the following steps.

( ) Locate the switch bracket and position it as shown.

( ) Refer to Detail 2-13A and install a rotary switch on the switch bracket at AC. Position the locating tab on the switch in the small hole in the switch bracket. Use a control lockwasher and a control nut.

( ) Refer to Detail 2-13B and install a rocker switch on the switch bracket at AD. Position the switch so the lugs are as shown. Use 4-40 x 1/4" screws and #4 lockwashers.

( ) Refer to Detail 2-13B and install a switch insulator on the lugs of switch AD.

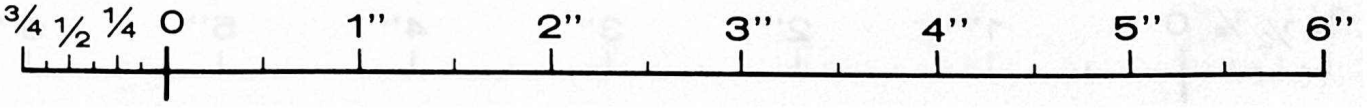
( ) Prepare the following lengths of wire:

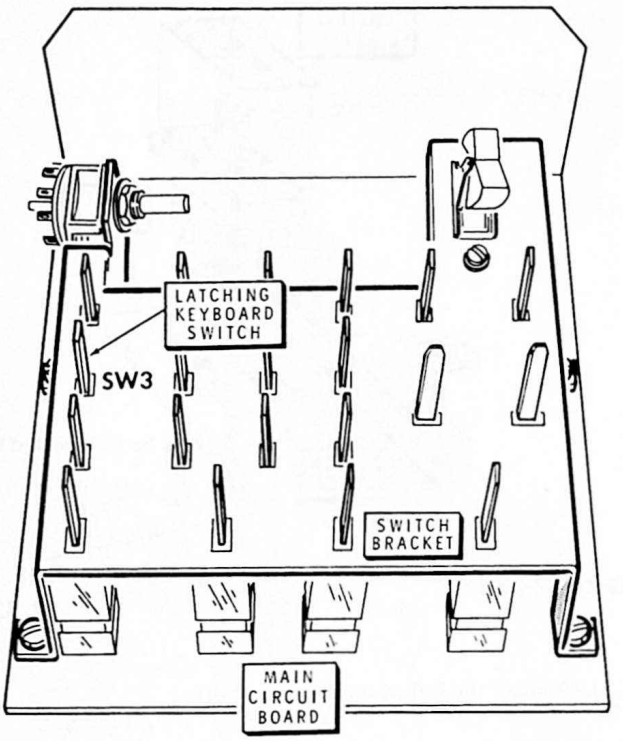
10" red
10" red

( ) Connect one end of a 10" red wire to lug 1 of switch AD (S-1). Make a mechanically secure connection before soldering. The other end of this wire will be connected later.

( ) Connect one end of a 10" red wire to lug 2 of switch AD (S-1). Make a mechanically secure connection before soldering. The other end of this wire will be connected later.

( ) Place four 1/4" lengths of sleeving over both 10" red wires coming from switch AD. Space the lengths of sleeving approximately 3" apart.





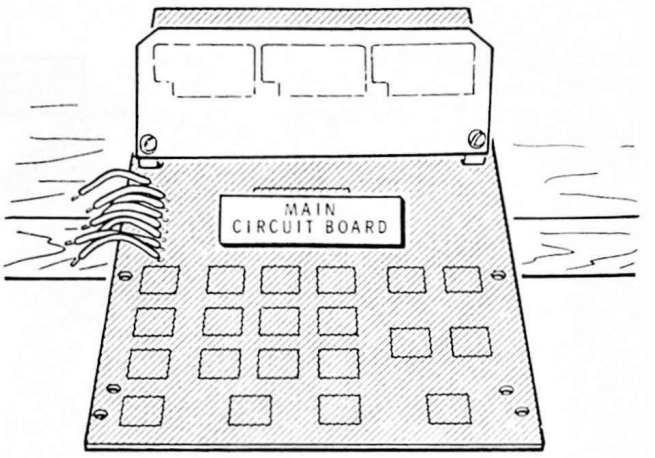
PICTORIAL 2-14

Refer to Pictorial 2-14 for the following steps.

( ) Refer to Detail 2-14A and position the wires coming from holes D1 through D0 to the left side of the circuit board.

( ) Locate the twenty keyboard switches.

NOTE: When you install the keyboard switches in the following steps, position each switch so it fits within the outline on the circuit board. Do not solder the switches to the foil until you are specifically instructed to do so in a step.



Detail 2-14A

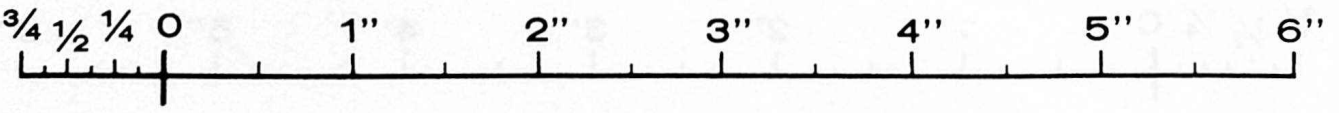
( ) Refer to Detail 2-14A and position the circuit board at the edge of your work area as shown. The keyboard switches are now easily installed and will remain upright on the circuit board.

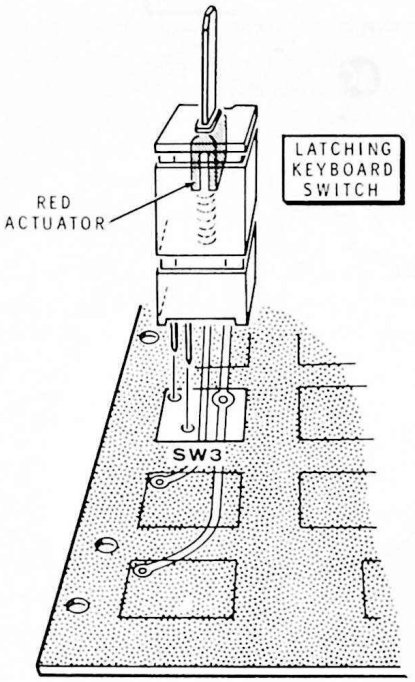
( ) Refer to Detail 2-14B and locate the latching keyboard switch. This switch can be identified by the red actuator within the switch.

( ) Refer to Detail 2-14B and install the latching keyboard switch SW3 on the main circuit board.

( ) Likewise, install the remaining non-latching keyboard switches on the main circuit board at locations SW1, SW2, and SW4 through SW20.

NOTE: Use the plastic nut starter supplied with this kit to hold and start 6-32 nuts on screws.

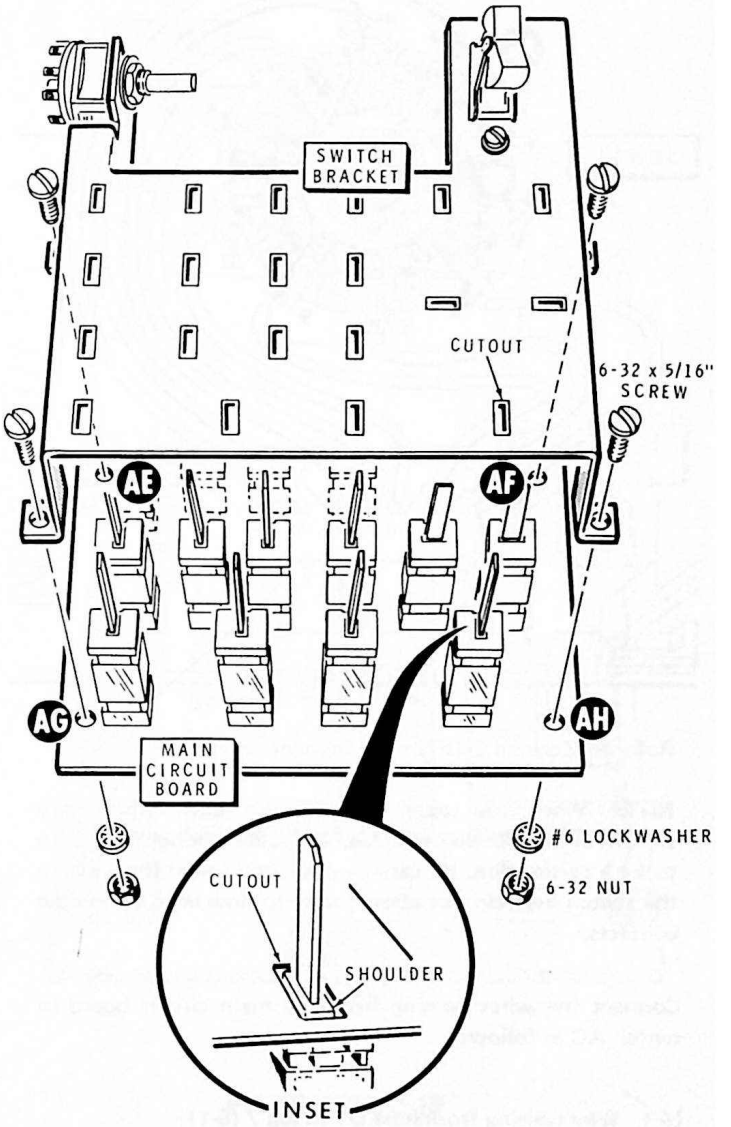




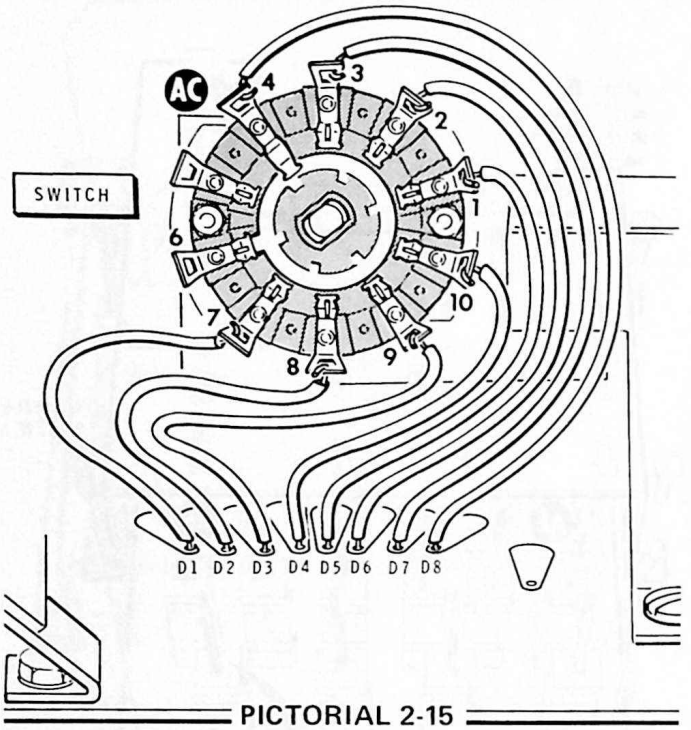
Detail 2-14B

( ) Refer to Detail 2-14C and install the previously assembled switch bracket over the keyboard switches. Use 6-32 x 5/16" hardware at AE, AF, AG, and AH. Be sure the shoulder on each keyboard switch (see inset drawing) is seated in the corresponding cutout in the switch bracket before tightening the hardware.

( ) Now solder the lugs of the keyboard switches to the foil and cut off the excess lead lengths.



Detail 2-14C



PICTORIAL 2-15

Refer to Pictorial 2-15 for the following steps.

NOTE: When you solder wires to the lugs of the rotary switch in the following steps, use only enough solder to make a connection. Be careful when you solder the wires to the switch lugs; do not allow solder to flow onto the switch contacts.

Connect the wires coming from the main circuit board to switch AC as follows:

( ) Wire coming from hole D1 to lug 7 (S-1).

( ) Wire coming from hole D2 to lug 8 (S-1).

( ) Wire coming from hole D3 to lug 9 (S-1).

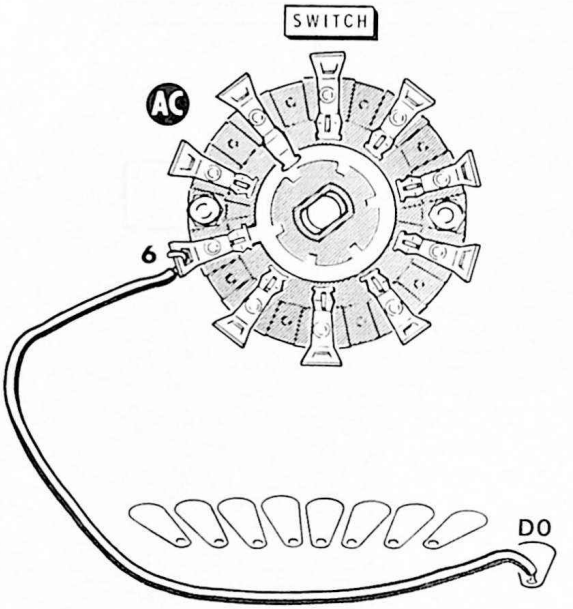
( ) Wire coming from hole D4 to lug 10 (S-1).

( ) Wire coming from hole D5 to lug 1 (S-1).

( ) Wire coming from hole D6 to lug 2 (S-1).

( ) Wire coming from hole D7 to lug 3 (S-1).

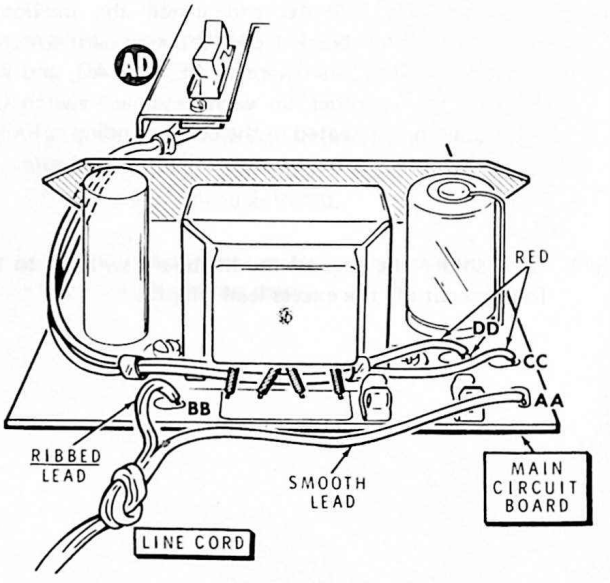
( ) Wire coming from hole D8 to lug 4 (S-1).



PICTORIAL 2-16

Refer to Pictorial 2-16 for the following step.

( ) Wire coming from hole D0 to lug 6 (S-1).



PICTORIAL 2-17

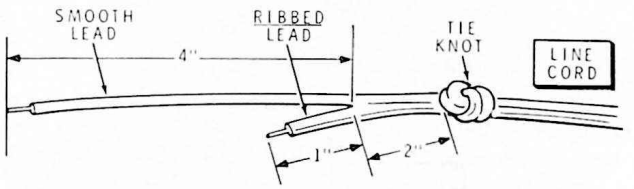
Refer to Pictorial 2-17 for the following steps.

( ) Route the red wires coming from switch AD as shown.

( ) Connect either red wire coming from switch AD to hole DD in the main circuit board (S-1).

( ) Connect the remaining red wire coming from switch AD to hole CC in the main circuit board (S-1).

NOTE: The line cord supplied with this kit has one of its outer wires marked with a rib in the insulation along its edge. The other wire is smooth. It is important that you connect the ribbed wire as indicated.



Detail 2-17A

( ) Refer to Detail 2-17A and prepare the end of the line cord.

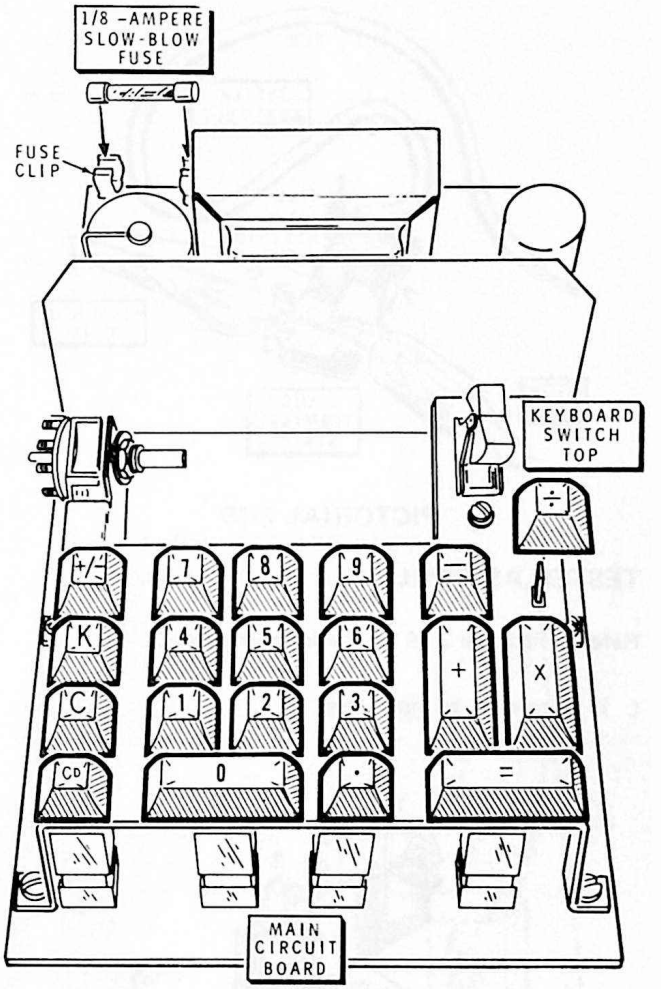
( ) Twist the bare wire strands together and melt a small amount of solder on the strands to hold them together.

( ) Connect the smooth line cord wire to hole AA in the main circuit board (S-1).

( ) Connect the ribbed line cord wire to hole BB in the main circuit board (S-1).

Refer to Pictorial 2-18 for the following steps.

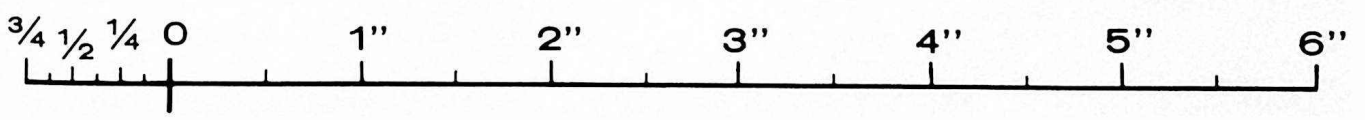
( ) Press the keyboard switch tops onto the proper keyboard switches as shown in the Pictorial.

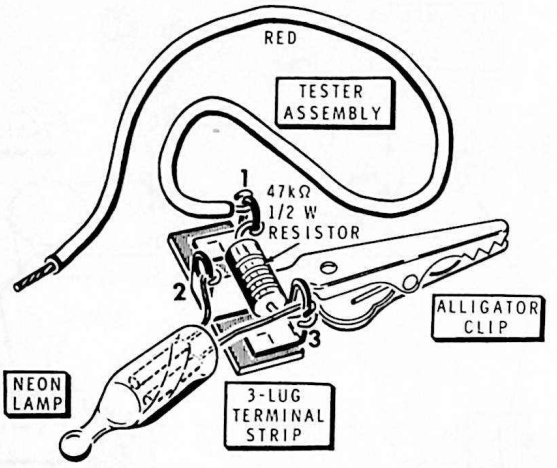


PICTORIAL 2-18

( ) Install the 1/8-ampere slow-blow fuse (1/16-ampere if wired for 240 VAC operation) in the fuse clips.

NOTE: The large integrated circuit (#443-88) and the display tubes will be installed later.



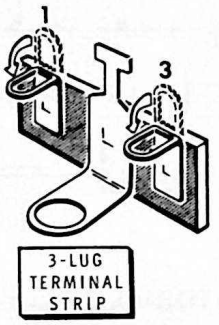


PICTORIAL 2-19

TESTER ASSEMBLY

Refer to Pictorial 2-19 for the following steps.

( ) Locate the terminal strip.



Detail 2-19A

( ) Refer to Detail 2-19A and bend lugs 1 and 3 of the terminal strip as shown.

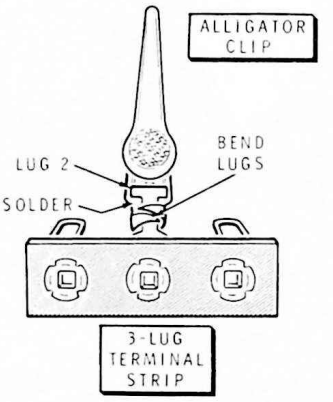
( ) Connect a 47 kΩ, 1/2-watt (yellow-violet-orange) resistor between lugs 1 (NS) and 3 (NS) of the terminal strip.

( ) Connect the neon lamp between lugs 2 (S-1) and 3 (S-2) of the terminal strip.

( ) Prepare the ends of the remaining length of red wire.

( ) Connect one end of the red wire to lug 1 of the terminal strip (S-2). The other end of this wire will be used as a test lead in the "Test" section of the Manual.

( ) Turn the terminal strip over.



Detail 2-19B

( ) Refer to Detail 2-19B and bend the tabs of the small alligator clip around lug 2 of the terminal strip. Then solder the alligator clip to lug 2.

( ) Carefully inspect the circuit boards to be sure all connections are properly soldered and that no solder bridges exist across adjacent foils, especially around the IC connectors. Also, examine the wiring to be sure there are no wire clippings or solder splashes lodged in the wiring or across any connections.

This completes the wiring of your Calculator and Tester. Proceed to the "Test" section.

TEST

The purpose of the "Test" section of the Manual is to make sure your Calculator operates properly and will not be damaged as a result of a wiring error. A transistor or integrated circuit, for example, could be destroyed instantly by a short circuit that causes excessive current.

The tester will be used in the following steps to check for the presence of high voltage. Three voltages of the power supply will be checked (+80V, +125V, and +220V). Also, each connector of the IC1 socket will be checked for the presence of a high voltage that could damage the integrated circuit.

INITIAL TEST

CAUTION: Line voltage is present on the main circuit board when the line cord is plugged into an AC outlet. High voltage is also present when the Power switch is turned on. Be careful that you do not contact this voltage or an electrical shock will result. See Figure 1-1.

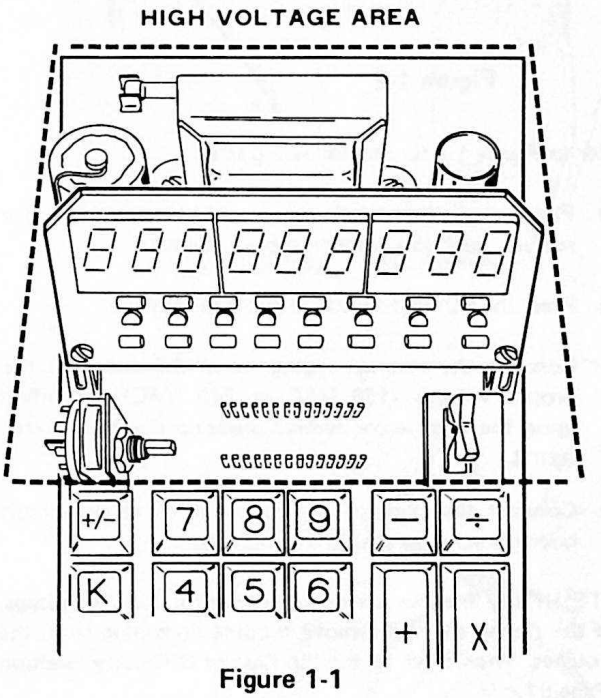


Figure 1-1

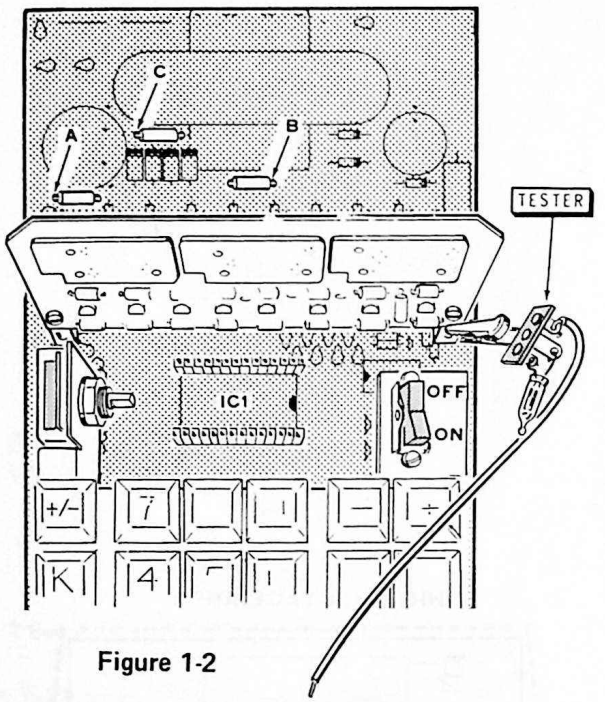


Figure 1-2

Refer to Figure 1-2 for the following steps.

( ) Place the Calculator on a clean non-conductive surface, such as a wooden table or bench.

( ) Press the POWER switch to the OFF position.

( ) Connect the line cord plug to an AC outlet of the proper voltage (120 VAC or 240 VAC) depending upon the voltage connection made on the main circuit board.

( ) Connect the alligator clip of the tester to the circuit board bracket as shown in Figure 1-2.

NOTE: If any trouble is encountered in the following steps, turn the power off and remove the line cord plug from the AC outlet. Then refer to the "In Case of Difficulty" section on Page 51.

( ) Press the POWER switch to the ON position.

( ) Touch the end of the red wire to point A (70 VDC-85 VDC) on the main circuit board. Point A is at the left end of the 22 kΩ (red-red-orange) resistor. The neon lamp on the tester should glow.

( ) Touch the end of the red wire to point B (120 VDC to 130 VDC) on the main circuit board. Point B is at the right end of the 47 kΩ (yellow-violet-orange) resistor. The neon lamp on the tester should glow.

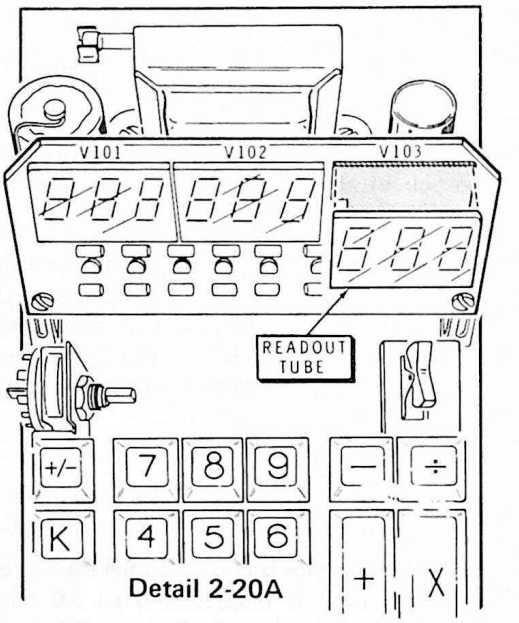
( ) Touch the end of the red wire to point C (215 VDC to 225 VDC) on the main circuit board. Point C is at the left end of the 220 Ω (red-red-brown) resistor. The neon lamp on the tester should glow.

( ) Touch the end of the red wire to each connector at IC1. The neon lamp should not glow. If the neon lamp glows when the red wire is touched to a connector, refer to the "In Case of Difficulty" section on Page 51.

( ) Press the POWER switch to the OFF position and remove the line cord plug from the AC outlet.

( ) Disconnect the tester and set it aside.

Refer to Pictorial 2-20 (fold-out from Page 33) for the following steps.



Detail 2-20A

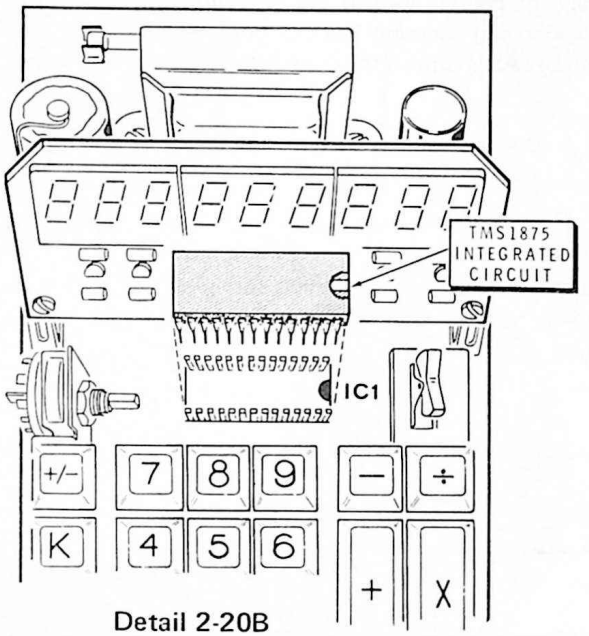
NOTE: When you install the display tubes in the following steps, support the rear of the readout circuit board to prevent breakage.

( ) Refer to Detail 2-20A and install a display tube at V103. Examine the pins to make sure they are straight before you install the tube. Also, be sure the glass seal is positioned in the cutout of the socket. As you install each tube, watch the leads to make sure each one goes into the connector.

( ) Likewise, install display tubes at V102 and V101.

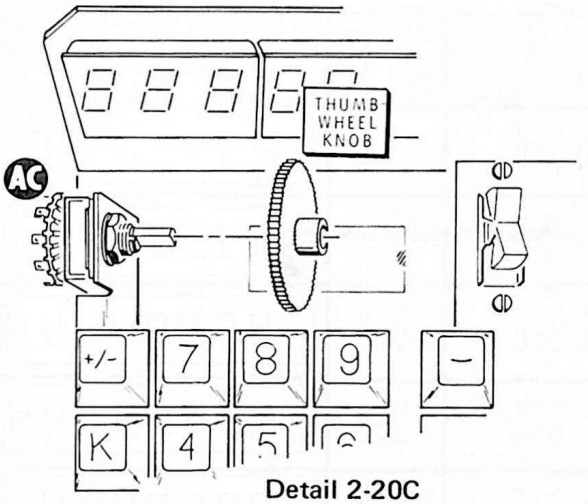
NOTE: The large integrated circuit can be damaged by static voltage. However, to prevent this, perform the following steps exactly as instructed.

( ) Being careful not to touch the leads, pick up the TMS1875 integrated circuit (#443-88) with one hand; then touch and hold the transformer (on the main circuit board) with your other hand.



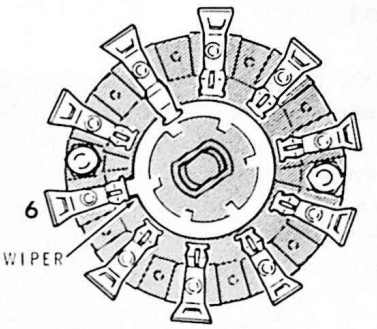
Detail 2-20B

(✓) Refer to Detail 2-20B and position the notch or the dot end of the IC over the half dot screened on the main circuit board. Then insert the IC leads into the IC connectors. Be sure each IC lead is properly inserted in the individual connector. DO NOT solder the IC to the connectors.



Detail 2-20C

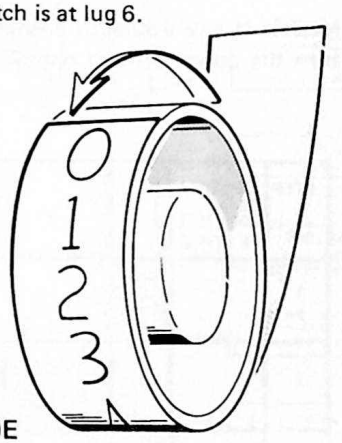
( ) Refer to Detail 2-20C and install the thumbwheel knob on the shaft of rotary switch AC. Be sure the knob is positioned as shown.



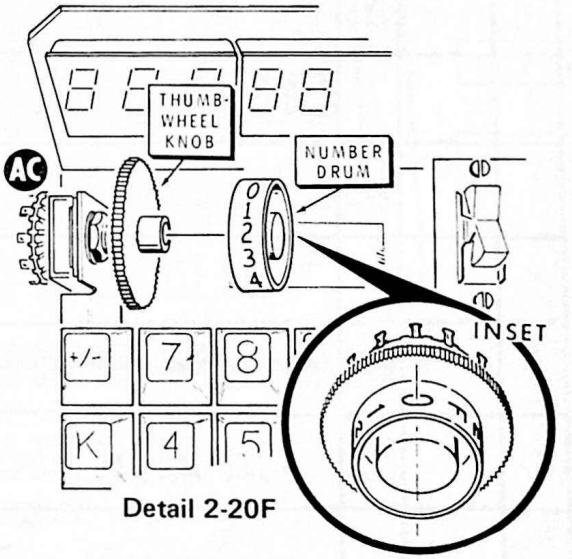
Detail 2-20D

( ) Refer to Detail 2-20D and turn the thumbwheel knob so the wiper of the switch is at lug 6.

( ) Refer to Detail 2-20E and install the number label on the number drum. Be sure the drum is positioned as shown; then remove the backing paper from the label and press it into place.



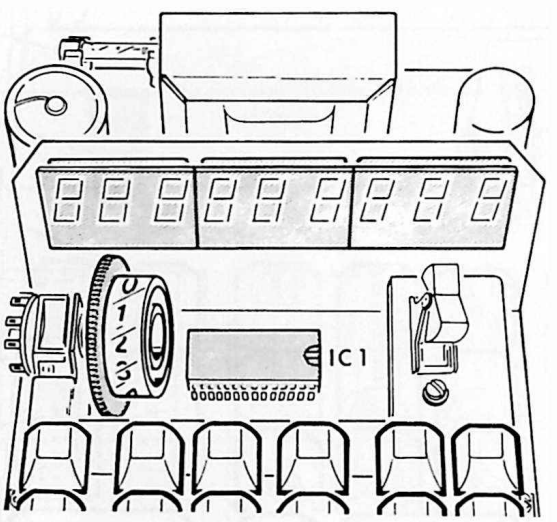
Detail 2-20E



Detail 2-20F

( ) Refer to Detail 2-20F and install the number drum part way on the thumbwheel. Do not allow the thumbwheel to turn as you install the number drum.

( ) Hold the thumbwheel and turn the number drum until the number 0 is facing upward as shown in the inset drawing. Then push the number drum all the way onto the thumbwheel knob.



PICTORIAL 2-20

STEP	DECIMAL POINT CONTROL SETTING		NUMBER	FUNCTION	READOUT
12		C			0.
13	0	C		=	0.
14	1	C		=	0.0
15	2	C		=	0.00
16	3	C		=	0.000
17	4	C		=	0.0000
18	5	C		=	0.00000
19	6	C		=	0.000000
20	7	C		=	0.0000000
21	F	C		=	0.
22			1 2 3 4 5	+	12345.
23			8 7 6 5 4	=	99999.
24		C	7 6 8 5	−	7685.
25			6 6 8 7	=	998.
26		C	. 8 9	÷	0.89

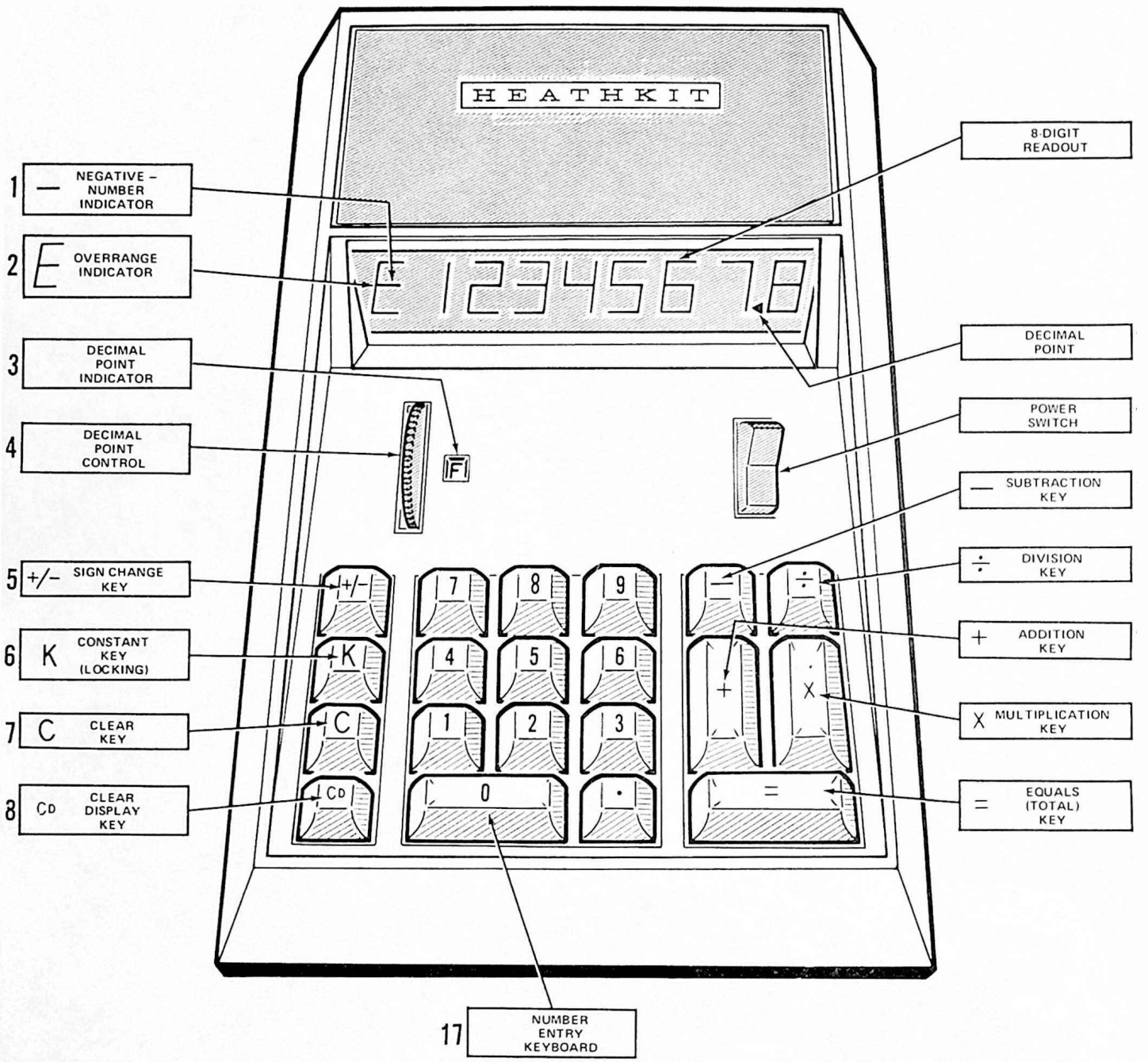

HEATHKIT
E 12345678
1 — NEGATIVE – NUMBER INDICATOR
2 E OVERRANGE INDICATOR
3 DECIMAL POINT INDICATOR
4 DECIMAL POINT CONTROL
5 +/– SIGN CHANGE KEY
6 K CONSTANT KEY (LOCKING)
7 C CLEAR KEY
8 CD CLEAR DISPLAY KEY
8-DIGIT READOUT
DECIMAL POINT
POWER SWITCH
— SUBTRACTION KEY
÷ DIVISION KEY
+ ADDITION KEY
X MULTIPLICATION KEY
= EQUALS (TOTAL) KEY
17 NUMBER ENTRY KEYBOARD

Figure 2-1

OPERATIONAL TEST

This section of the Manual will check the basic Calculator functions to make sure they are working properly. The entries that will be made on the keyboard are not necessarily related to the actual use of the Calculator. The entry of 88888888, for example, is used to check the seven segments of each digit. Actual use of each function is explained in detail in the "Operation" section.

Refer to Figure 2-1 to identify the function of each control and keyboard key.

NOTE: If any trouble is encountered in the following steps, turn the power off and remove the line cord plug from the AC outlet. Then refer to the "In Case of Difficulty" section on Page 51.

Each numbered step in the following charts shows which number and function keys to push, and what the readout will be. Always push the keys in the sequence shown.

( ) Connect the line cord plug to an AC outlet.

( ) Press the POWER switch to the ON position.

NOTE: When the Calculator is turned on in a dimly lit area, it may take as long as one minute before the display will light.

STEP	DECIMAL POINT CONTROL SETTING		NUMBER	FUNCTION	READOUT
1	F	C			0.
2			8 8 8 8 8 8 8 8 +/-		-88888888.
3		C			0.
4			1 . 2 3 4 5 6 7 8		1.2345678
5		CE			0.
6			2 3 4 5 6 7 8 9		23456789.
7		C	3 4 5 6 7 8 9 . 0		34567890
8		C	9 9 9 9 9 9 9 9	X	99999999.
9			9	=	E8.9999999
10		C	9 9 9 9 9 9 9 9	X	99999999.
11			9 +/-	=	E8.9999999

OPERATIONAL TEST

This section of the Manual will check the basic Calculator functions to make sure they are working properly. The entries that will be made on the keyboard are not necessarily related to the actual use of the Calculator. The entry of 88888888, for example, is used to check the seven segments of each digit. Actual use of each function is explained in detail in the "Operation" section.

Refer to Figure 2-1 to identify the function of each control and keyboard key.

NOTE: If any trouble is encountered in the following steps, turn the power off and remove the line cord plug from the AC outlet. Then refer to the "In Case of Difficulty" section on Page 51.

Each numbered step in the following charts shows which number and function keys to push, and what the readout will be. Always push the keys in the sequence shown.

( ) Connect the line cord plug to an AC outlet.

( ) Press the POWER switch to the ON position.

NOTE: When the Calculator is turned on in a dimly lit area, it may take as long as one minute before the display will light.

STEP	DECIMAL POINT CONTROL SETTING		NUMBER	FUNCTION	READOUT
1	F	C			0.
2			8 8 8 8 8 8 8 8 +/-		-88888888.
3		C			0.
4			1 . 2 3 4 5 6 7 8		1.2345678
5		CE			0.
6			2 3 4 5 6 7 8 9		23456789.
7		C	3 4 5 6 7 8 9 . 0		3456789.0
8		C	9 9 9 9 9 9 9 9	X	99999999.
9			9	=	E8.9999999
10		C	9 9 9 9 9 9 9 9	X	99999999.
11			9 +/-	=	E8.9999999

STEP	DECIMAL POINT CONTROL SETTING		NUMBER	FUNCTION	READOUT
12		C			0.
13	0	C		=	0.
14	1	C		=	0.0
15	2	C		=	0.00
16	3	C		=	0.000
17	4	C		=	0.0000
18	5	C		=	0.00000
19	6	C		=	0.000000
20	7	C		=	0.0000000
21	F	C		=	0.
22			1 2 3 4 5	+	12345.
23			8 7 6 5 4	=	99999.
24		C	7 6 8 5	−	7685.
25			6 6 8 7	=	998.
26		C	. 8 9	÷	0.89

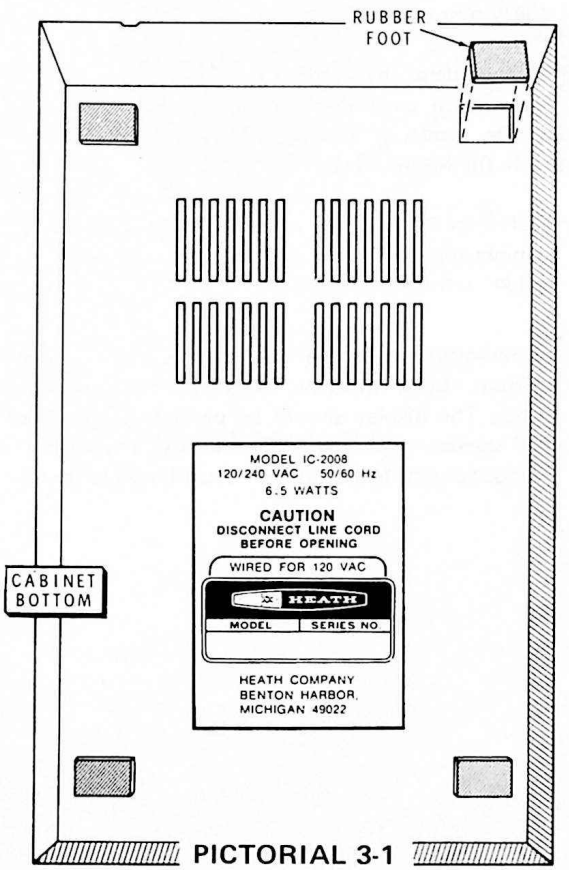
STEP	DECIMAL POINT CONTROL SETTING		NUMBER	FUNCTION	READOUT
27			[.] [9]	[=]	0.9888888
28		[C]	[.] [0] [0] [3]	[x]	0.003
29			[6] [6] [6] [6]	[=]	19.998
30		[C]	[1]	[÷]	1.
31		[K] ↓	[1] [6]	[=]	0.0625
32			[2]	[=]	0.125
33			[3]	[=]	0.1875
34			[4]	[=]	0.25
35		[K] ↑ [C]			0.

( ) Press the POWER switch to the OFF position.

( ) Disconnect the line cord plug from the AC outlet.

This completes the Operational Test. Proceed to "Cabinet Assembly."

CABINET ASSEMBLY



PICTORIAL 3-1

Refer to Pictorial 3-1 for the following steps.

( ) Position the cabinet bottom upside down as shown.

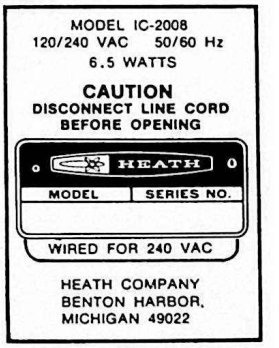
( ) Remove the backing paper from the rubber feet. Install a rubber foot in the depression at each corner of the cabinet bottom.

( ) Remove the backing paper from the power requirements label and install it on the cabinet bottom.

NOTE: If the transformer was wired for 120 VAC operation, perform the following step. If the transformer was wired for 240 VAC operation, disregard the following step.

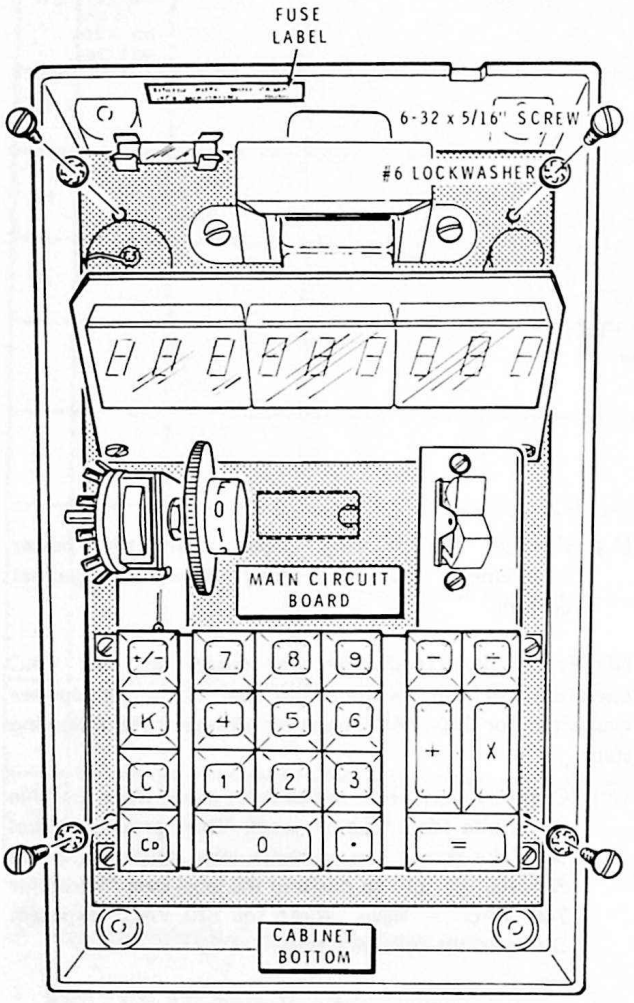
( ) Carefully peel away the backing paper from the blue and white identification label. Then press the label onto the power requirements label as shown in the Pictorial. Be sure to position the label over "Wired for 240 VAC" – leave "Wired for 120 VAC" exposed. Disregard the following step.

( ) Carefully peel away the backing paper from the blue and white identification label. Then press the label onto the power requirements label as shown in Detail 3-1A. Be sure to position the label over "Wired for 120 VAC" – leave "Wired 240 VAC" exposed.



Detail 3-1A

NOTE: The blue and white identification label shows the model number and production series number of your kit. Refer to these numbers in any communication with Heath Company; this assures you that you will receive the most complete and up-to-date information in return.



PICTORIAL 3-2

Refer to Pictorial 3-2 for the following steps.

( ) Position the cabinet bottom as shown.

( ) Locate the fuse label. Record the fuse rating on the label (1/8-ampere for 120 VAC operation or 1/16 ampere for 240 VAC operation).

( ) Remove the backing paper from the fuse label. Then press the label onto the inside of the cabinet bottom as shown.

( ) Install the main circuit board in the cabinet bottom. Use 6-32 x 5/16" screws and #6 lockwashers.

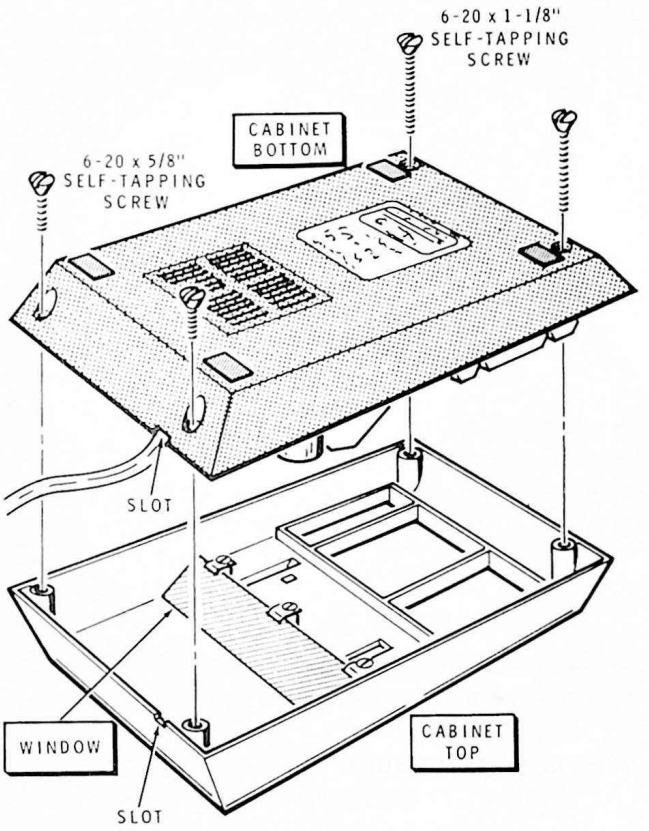
Refer to Pictorial 3-3 for the following steps.

( ) Peel away the protective covering from both sides of the window.

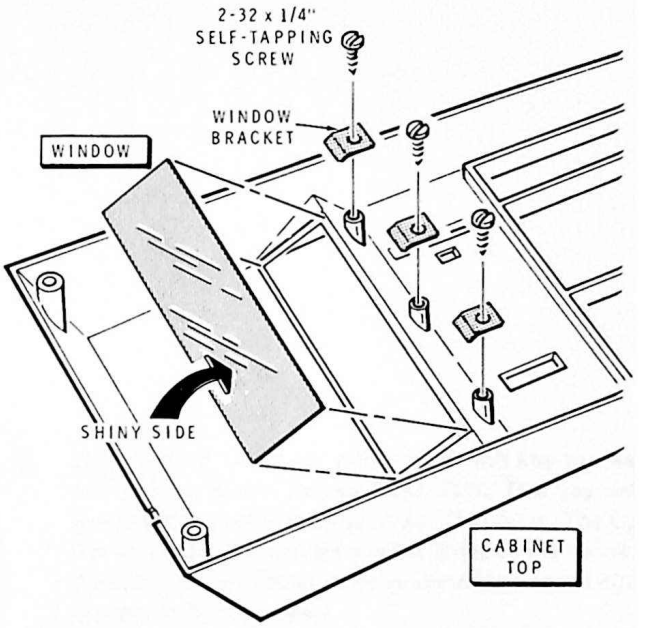
NOTE: One side of the window is shiny and the other side is dull. Be sure to position the window with the shiny side toward the inside of the cabinet when you install the window in the following step.

( ) Refer to Detail 3-3A and install the window in the cabinet top. Use three window brackets and three 2-32 x 1/4" self-tapping screws.

( ) Temporarily place the cabinet top on the cabinet bottom. Look through the window at the display tubes. The display should be parallel to the edges of the window opening. If necessary, reposition the readout circuit board on the circuit board brackets.



PICTORIAL 3-3



Detail 3-3A

(,) Install the cabinet top on the cabinet bottom. Use two 6-20 x 5/8" self-tapping screws in the rear holes and 6-20 x 1-1/8" self-tapping screws in the front holes of the cabinet. Be sure the line cord is positioned in the small cutout at the rear of the cabinet bottom and the knot is on the inside of the cabinet.

This completes the assembly, wiring, and testing of your Electronic Desk-Top Calculator. Proceed to the "Operation" section.

OPERATION

You can add, subtract, multiply, and divide quickly and accurately in an easy, straight-forward way. This section of the Manual details each function of the Calculator. Study the following information to become familiar with the Calculator and its operation.

OPERATING FEATURES

Figure 2-1 (fold-out from Page 34) points out the operating features of the Calculator. Each feature is described below:

1. NEGATIVE NUMBER INDICATOR – Lights to indicate a negative number.

2. OVERRANGE INDICATOR – Lights when the whole-number capacity of the Calculator has been exceeded.

3. DECIMAL POINT INDICATOR – Shows the position of the DECIMAL POINT control.

4. DECIMAL POINT CONTROL – Selects the location of the decimal point in the answer. The numbered positions of this control will set the decimal point to any place from 0 to 7. The "F" (floating) positions automatically place the decimal point far enough to the left to include all significant numbers in the answer. (Both F positions are identical.)

5. (+/–) SIGN CHANGE KEY – Push this key to change the sign of the number shown on the READOUT.

6. (K) CONSTANT KEY – Push this key before you enter a number that will be used as a constant for multiplication or division. The key will lock in the down position when pushed, and will release to the up position when pushed again.

7. (C) CLEAR KEY – Push this key to clear all numbers in the Calculator and reset it to zero.

8. (C_D) CLEAR DISPLAY KEY – Push this key to clear any number shown on the READOUT. This key will not affect any other number in the Calculator. The C_D key will clear an incorrect number entry so the correct number can be entered without disturbing an existing number in the Calculator.

9. 8-DIGIT READOUT – Displays the numbers in the calculation process.

10. DECIMAL POINT – Indicates the location of the decimal point in the number shown on the READOUT.

11. POWER SWITCH – Turns the Calculator on and off.

12. (–) SUBTRACTION KEY – Push this key before you enter a number to be subtracted from an existing number in the Calculator.

13. (÷) DIVISION KEY – Push this key before you enter a number to be divided into an existing number in the Calculator.

14. (+) ADDITION KEY – Push this key before you enter a number to be added to an existing number in the Calculator.

15. (X) MULTIPLICATION KEY – Push this key before you enter a number to be multiplied by an existing number in the Calculator.

16. (=) EQUALS (TOTAL) KEY – Push this key to terminate a calculation and see the resulting answer on the READOUT.

17. NUMBER ENTRY KEYBOARD – Use these keys to enter numbers into the Calculator.

OPERATING PROCEDURE

Charts 1 through 4, which follow, illustrate the four basic functions of the Calculator: ADDITION, SUBTRACTION, MULTIPLICATION, and DIVISION. Chart 5 shows mixed calculations; Charts 6 and 7 show multiplication and division by a constant; Charts 8 and 9 show how to calculate positive and negative powers of numbers; Chart 10 shows the use of the (C_D) CLEAR DISPLAY.

Before you begin any calculation, it is good practice to push the (C) CLEAR key to clear the Calculator.

Each numbered step (line) of the Charts shows which input and function keys to push, and what the readout will be.

As you become familiar with using the Calculator, it will be helpful to refer to these charts from time to time.

NOTES:

1. The Calculator should be connected to an appropriate AC power source and turned on. No warmup time is required.

2. When the Calculator is turned on in a dimly lit area, it may take as long as one minute before the display will light.

CHART #1 – ADDITION

ADD: 155.1 + 25.3 = 180.4 — **DECIMAL POINT SETTING: 1**

STEP	NUMBER	FUNCTION	READOUT
1	1 5 5 . 1	+	155.1
2	2 5 . 3	=	180.4

CHART #2 – SUBTRACTION

SUBTRACT: 108.48 − 48.22 = 60.26 — **DECIMAL POINT SETTING: 2**

STEP	NUMBER	FUNCTION	READOUT
1	1 0 8 . 4 8	−	108.48
2	4 8 . 2 2	=	60.26

CHART #3 – MULTIPLICATION

MULTIPLY: 225 × 3 = 675

DECIMAL POINT SETTING: F

STEP	NUMBER	FUNCTION	READOUT
1	2 2 5	X	225
2	3	=	675

CHART #4 – DIVISION

DIVIDE: 444 ÷ 4 = 111

DECIMAL POINT SETTING: F

STEP	NUMBER	FUNCTION	READOUT
1	4 4 4	÷	444
2	4	=	111

CHART #5 – MIXED CALCULATIONS IN SERIES

ADD, SUBTRACT, ADD, MULTIPLY, AND DIVIDE IN SERIES:

$$\frac{(15 + 20 - 5 + 12) \times 8}{4} = 84$$

DECIMAL POINT SETTING: F

STEP	INPUT	FUNCTION	READOUT
1	1 5	+	15.
2	2 0	−	35.
3	5	+	30.
4	1 2	×	42.
5	8	÷	336.
6	4	=	84.

HEATH
Schlumberger

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022
PHONE 616-983-3961 TWX 616-983-3897

August 17, 1972

Dear Customer:

Please tape "Chart #6" on this letter over "Chart #6" on Page 45 of your Manual.

Thank you,

HEATH COMPANY

IC-2008/595-1454
591-1050

CHART #6 – MULTIPLYING BY A CONSTANT, K

WHERE CONSTANT K = 3: **DECIMAL POINT SETTING: F**

2 x K = 6
8 x K = 24
40 x K = 120

STEP	INPUT	FUNCTION	READOUT
1	2	X	2.
2	K ↓ *3	=	6.
3	8	=	24.
4	4 0	=	120.
5	K ↑		

*NOTE THAT FOR MULTIPLICATION THE CONSTANT IS THE SECOND NUMBER ENTERED.

CHART #7 – DIVIDING BY A CONSTANT, K

WHERE CONSTANT K = 4: **DECIMAL POINT SETTING: F**

12 ÷ K = 3
20 ÷ K = 5
28 ÷ K = 7

STEP	INPUT	FUNCTION	READOUT
1	1 2	÷	12.
2	K ↓ *4	=	3.
3	2 0	=	5.
4	2 8	=	7.
5	K ↑		

*NOTE THAT THE CONSTANT IS THE SECOND NUMBER ENTERED.

CHART #8 – RAISING A NUMBER TO A POWER

RAISE 8 TO ITS FOURTH POWER: **DECIMAL POINT SETTING: F**

$8^4 = 8 \times 8 \times 8 \times 8 = 4096$

STEP	INPUT	FUNCTION	READOUT
1	8	X	8.
2	8	X	64.
3	8	X	512.
4	8	=	4096.

CHART #9 – CALCULATING NEGATIVE POWERS OF NUMBERS

CALCULATE: THE NEGATIVE FOURTH POWER OF 2: **DECIMAL POINT SETTING: F**

$$2^{-4} = \frac{1}{2^4} = \frac{1}{2 \times 2 \times 2 \times 2} = 1 \div 2 \div 2 \div 2 \div 2 = .0625$$

STEP	INPUT	FUNCTION	READOUT
1	2	÷	2.
2	2	÷	1.
3	2	÷	0.5
4	2	÷	0.25
5	2	÷	0.125
6	2	=	0.0625

CHART #10 – USING THE C_D KEY TO REMOVE ERRONEOUS INPUT NUMBERS

MULTIPLY, SUBTRACT, AND DIVIDE IN SERIES: $\frac{(6 \times 10) - 21}{3} = 13$

DECIMAL POINT SETTING: F

STEP	INPUT	FUNCTION	READOUT
1	6	X	6.
2	1 0	−	60.
3	ERROR 2 0		−20.
4	CLEAR DISPLAY C$_D$	−	60.
5	2 1	÷	39.
6	3	=	13.

OPERATING CONSIDERATIONS

Readout

Each digit section of the READOUT is capable of displaying any number 0 through 9.

A characteristic of the Calculator is that the readout will display a "small zero" in each digit section to the left of the numbers in the significant display. These small zeros also indicate the remaining unused digits in the display.

Operating Temperature

The solid-state devices in the Calculator are designed to operate normally at temperatures between 0 and 40 degrees Centigrade (32 to 104 degrees Fahrenheit). If you operate the calculator in temperatures outside of this range, you may encounter inaccurate operation.

Negative Numbers

Negative numbers can be used in any calculations. To establish a negative number, push the (+/—) key immediately after you enter the number.

Decimal Places

Generally, the location of the decimal point in the answer is set by the DECIMAL POINT control. For example, with a DECIMAL POINT setting of 2, both of the following additions would be shown on the readout as 33.69:

	(A)		(B)
	16.59		16.5963
(+)	17.10	(+)	17.1024
	33.69		33.6987

To see the full answer for addition (B), you would have to use a decimal setting of 4 or higher, or use the F (floating) setting.

In calculations where the answer, including any numbers to the right of the decimal point, exceeds eight digits, only the first eight digits of the answer will be displayed. For example, in the following addition with a DECIMAL POINT setting of 3 or higher, the READOUT would show the answer as 14206.650:

	6843.6919
(+)	7362.9587
	14206.6506 ← NOT SHOWN
	8-DIGIT DISPLAY

Note that the last digit shown is not rounded off to indicate the value of the part of the answer which is beyond the readout capacity of the Calculator.

With an F DECIMAL POINT setting, only the last significant digit (within the 8-digit capacity of the Calculator) to the right of the decimal point is shown. Since "5" is the last significant digit in the answer to the addition above, the answer displayed would be 14206.65.

A characteristic of the Calculator is that any fractional number is always preceded by 0 (zero) or a whole number. This characteristic limits the input and readout capacity of the Calculator to seven digits to the right of the decimal point. The Calculator, however, can handle up to 14 places in multiplying and dividing fractional numbers.

Overrange

The OVERRANGE INDICATOR at the left end of the READOUT will light when the whole-number interim or final answer to a calculation is beyond the 8-digit capacity of the Calculator. In an overrange condition, the part of the answer shown will be correct, but the decimal point will be eight places to the left of its correct location and the part of the answer beyond eight digits will not be shown.

To eliminate an overrange condition you must press the (C) CLEAR key.

Ending a Calculation

When you have completed all inputs for a calculation, push the (=) EQUALS key. This displays the answer and prepares the Calculator for entry of the first number of the next calculation without having to push the (C) CLEAR key.

Subtotaling

In series calculations, you can push the (=) EQUALS key to display a subtotal. To continue with the calculation, you must push a function key (+, —, x, or ÷) before entering the next number.

IN CASE OF DIFFICULTY

This section of the Manual is divided into two parts. The first part, titled "General Troubleshooting Information," describes what to do about the difficulties that may occur right after your Calculator is assembled.

The second part, titled "Troubleshooting Chart," is provided to assist you in servicing the Calculator if the "General Troubleshooting Information" fails to clear up the problem, or if difficulties occur after your Calculator has been in use for some time. The "Troubleshooting Chart" lists a number of possible difficulties that could arise along with several possible solutions to those difficulties.

Try to analyze the symptoms of any problem you might have before starting any troubleshooting procedure. This can usually be accomplished by trying the various functions of your Calculator to determine abnormal operations. A review of the "Operation" section on Page 41 may help your analysis.

NOTE: Refer to the "Circuit Board X-Ray Views" on Page 61 for the physical location of parts on the circuit boards.

GENERAL TROUBLESHOOTING INFORMATION

1. Check all the wires that are connected between the two circuit boards and between the circuit boards and other parts. Trace each wire in colored pencil on the Pictorial as it is checked. Make sure these wires are connected to the proper points and are properly soldered. Someone who is not familiar with the unit may notice something you have consistently overlooked.

2. About 90% of the kits that are returned for repair do not function properly because of poor connections and soldering. Therefore, many troubles can be located by a careful inspection of connections to make sure they are soldered as described in the "Soldering" section of the "Kit Builders Guide." Reheat any doubtful connections.

3. Closely examine each circuit board foil in a good light to see that no solder bridges exist between adjacent connections. If available, a magnifying glass would be helpful for this purpose. Remove any solder bridges by holding a clean, hot soldering iron tip between the two points that are bridged until the excess solder flows down onto the tip. Compare your foil pattern against the "X-Ray Views" on Page 61.

4. Be sure each transistor is in its proper location (correct part number and/or type number). Be sure that each transistor lead is in the right hole and has a good solder connection to the foil.

5. Check the two integrated circuits for proper positioning. (Be sure the dot or notched end of the IC is over the half dot printed on the circuit board.) Be sure each IC pin is making good contact with its connector, and is not bent out or under the IC.

6. Check each capacitor value. Be sure that a capacitor of correct value is installed at each capacitor location. Check each electrolytic capacitor to be sure the lead near the positive (+) marking is at the correct position.

7. Check each resistor value carefully. It would be easy, for example, to install a 2200 Ω (red-red-red) resistor where a 22 kΩ (red-red-orange) resistor is called for. A resistor that is discolored, or cracked, or shows any sign of bulging would indicate that it is damaged and should be replaced. Since damaged resistors are often the result of some other difficulty (such as faulty wiring), you should try to find out what caused the damage before you replace the part.

8. Be sure the correct diode is installed at each diode location, and that the banded end is positioned correctly.

9. Check all component leads connected to the circuit boards. Make sure the leads do not extend through the circuit board and come in contact with other connections or parts.

If you still cannot locate and correct the trouble after the above tests are completed, and if a voltmeter is available, check your Calculator's voltages against the voltages shown on the Schematic Diagram (fold-out from Page 71) and in the "Circuit Board Voltage Charts" (Pages 65 through 67). If a voltmeter is not available, the tester that you assembled may be used to check for the presence of voltages of 59 volts or higher.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Service" section of the "Kit Builders Guide" and to the "Factory Repair Service" information on Page 54 of this Manual.

PRECAUTIONS FOR TROUBLESHOOTING

WARNING: Use extreme care when you measure voltages to prevent personal shock or instrument damage. Remember that hazardous voltages are exposed in the Calculator when the cabinet top is removed and the line cord is plugged into an AC outlet. See Figure 1-1 on Page 31.

1. Be sure you do not short any adjacent terminals or foils when making voltage measurements. If the probe should slip, for example, and short together two adjacent connections, it is very likely to cause damage to one or more IC's, transistors, or diodes.

2. Be especially careful when testing any circuit that contains an IC or a transistor. Although these components have an almost unlimited life when used properly, they are much more vulnerable to damage from excessive voltage or current than many other parts.

Troubleshooting Chart

This chart lists the condition and possible cause of several malfunctions. If a particular part or parts are mentioned (Q10 for example) as a possible cause, check that part to see that it was installed and/or wired correctly. It is also possible, on rare occasions, for a part to be faulty and require replacement.

CONDITION	POSSIBLE CAUSE
All display digits will not light.	1. AC line cord not connected to a working outlet. 2. Blown fuse. 3. ON-OFF switch. 4. One or more power supply voltages missing or of wrong value. (Refer to the schematic and use a voltmeter or your tester to check the voltage at test points A, B, and C.) The #6 fiber flat washer may be missing from bottom of the main circuit board (see Detail 2-9A). 5. Q19 and/or Q20. 6. Q21. 7. IC2. 8. Q26.
Every other display digit will not light.	1. Q19 or Q20. 2. Q21. 3. IC2.
The same segments in all display digits will not light.	1. Related segment driver transistor (Q101-Q108). 2. Wiring between main and readout circuit boards.
One or more different segments in one or more display digits will not light.	1. One or more bent pins on V101-V103. 2. Short between one or more readout circuit board foils.
Glow exists between adjacent display digits.	1. Emitters of even numbered transistors (Q10-Q18) are shorted to emitters of odd numbered transistors (Q10-Q18). 2. If a voltmeter is available, check the voltage on the emitter of Q19 or Q20. This voltage must be within 1.7 – 2.5 volts. 3. R55. 4. Q19 or Q20.
One digit dimly displays the same lighted segments as an adjacent digit.	
All digits glow dimly when lighted.	
One display digit will not light.	1. Pin 9 bent on associated tube (V101-V103). 2. Associated anode driver transistor (Q1-Q9).

FACTORY REPAIR SERVICE

You can return your completed kit to the Heath Company Service Department to have it repaired for a minimum service fee. (Kits that have been modified will not be accepted for repair.) Or, if you wish, you can deliver your kit to a nearby Heathkit Electronic Center. These centers are listed in your Heathkit catalog.

To be eligible for replacement parts under the terms of the warranty, equipment returned for factory repair service, or delivered to a Heathkit Electronic Center, must be accompanied by the invoice or the sales slip, or a copy of either. If you send the original invoice or sales slip, it will be returned to you.

If it is not convenient to deliver your kit to a Heathkit Electronic Center, please ship it to the factory at Benton Harbor, Michigan and observe the following shipping instructions:

Prepare a letter in duplicate, containing the following information:

- Your name and return address.
- Date of purchase.
- A brief description of the difficulty.
- The invoice or sales slip, or a copy of either.
- Your authorization to ship the repaired unit back to you C.O.D. for the service and shipping charges, plus the cost of parts not covered by the warranty.

Attach the envelope containing one copy of this letter directly to the unit before packaging, so that we do not overlook this important information. Send the second copy of the letter by separate mail to Heath Company, Attention: Service Department, Benton Harbor, Michigan 49022.

Check the equipment to see that all parts and screws are in place. Then, wrap the equipment in heavy paper. Place the equipment in a strong carton, and put at least THREE INCHES of resilient packing material (shredded paper, excelsior, etc.) on all sides, between the equipment and the carton. Seal the carton with gummed paper tape, and tie it with a strong cord. Ship it by prepaid express, United Parcel Service, or insured parcel post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

SPECIFICATIONS

DISPLAY

Readout	8-digit; 7-segment; single-plane.
Overflow	Indicated when result exceeds 8-digit capacity.
Sign	Negative (–) used for negative numbers.

KEYBOARD

Twenty Keys	10 number keys (0-9). 1 decimal point key (.). 4 function keys (+, –, x, ÷). 1 constant factor key (K). 1 equals key (=). 1 clear key (C). 1 clear display key (C_D). 1 positive and negative sign change key (+/–).

CAPABILITIES

Functions	Addition. Subtraction. Multiplication. Division
Computation Modes	Chain or constant.
Range	10^{-7} to 10^{8} (0.0000001 to 99999999).
Decimal Point Positions	7 fixed. 2 identical floating.
Locked Entry	When result exceeds 8-digit capacity.

Factor	Constant (K).
Clear Display	(C_D).
Clear Operation	(C).
Positive and Negative Sign	(+/–).

GENERAL

Operating Temperature	0 to 40 degrees C. 32 to 104 degrees F.
Line Voltage	120/240 volts AC, 50/60 Hz.
Power	6.5 watts.
Protection	1/8-ampere slow-blow fuse (120-VAC operation). 1/16-ampere slow-blow fuse (240-VAC operation).
Dimensions	10-1/4" long x 6" wide x 3-1/2" high.
Weight	3-1/2 lbs.

The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

CIRCUIT FUNDAMENTALS

Mathematical calculations are made possible in the Calculator through the use of many interrelated circuits that are programmed to act in a timed sequence. These "Circuit Fundamentals" will give you a better understanding of the circuit relationships within your Calculator and describe how they work together. Refer to the individual Figures as they are called for, and to the Schematic Diagram (fold-out from Page 71), while you read this information.

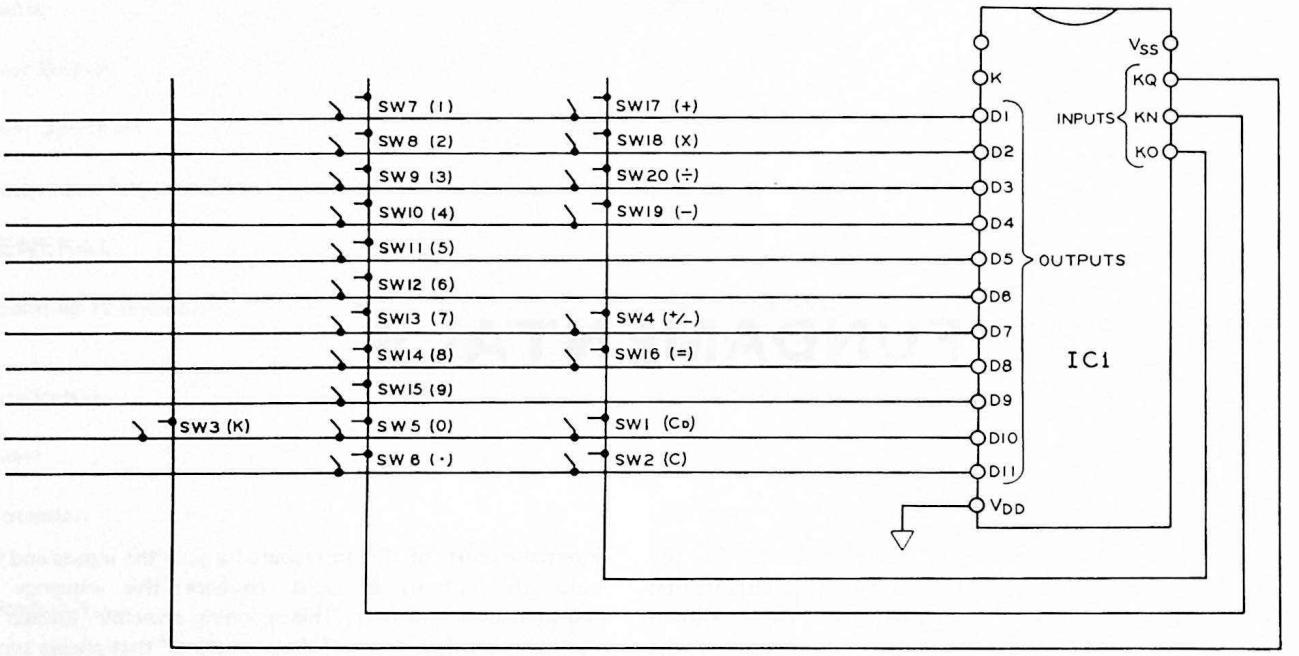
IC1

IC1 (Integrated Circuit 1) is the heart of your Calculator. This single "package" contains all the circuits that perform addition, subtraction, multiplication, and division. IC1 can perform these functions either individually or in continuous series.

Transistors Q22 through Q26 form an oscillator circuit that provides a signal to the Φ input of IC1. This signal causes the internal circuits of IC1 to repeatedly scan the inputs and to pulse the outputs in rapid sequence; this sequence is repeated over and over. This scanning principle, known as multiplexing, is a form of "time sharing" that allows some of the outputs of IC1 to be used for both Keyboard inputs and Readout display outputs.

IC1 is also internally programmed to provide protection against key double-entry and transient noise signals. Each time a key is pressed, the IC samples the key switch entry. The same entry is sampled again 2.5 milliseconds later to determine its validity. If the entry is proven valid, the IC memorizes and transfers that particular entry to the driving circuits that light the Readout.

Automatic locking circuits, within IC1, prevent the entry of more than eight digits into the Calculator.



KEYBOARD SWITCH CONNECTIONS
Figure 3-1

KEYBOARD

Mathematical commands and numbers are entered into the Calculator through the individual keys of the Keyboard. Each Keyboard switch is connected between an input and output line of IC1 (Figure 3-1). Pressing the keys provides IC1 with the necessary information to perform the mathematics of the particular problem entered.

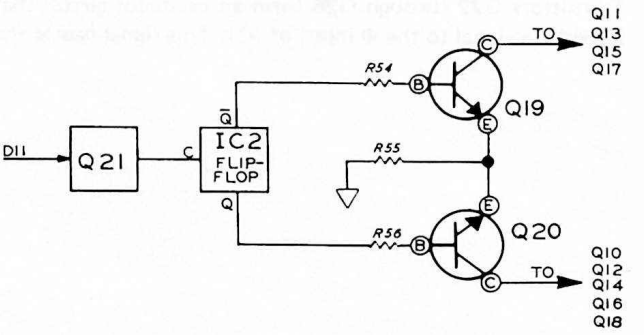
READOUT CIRCUIT

The readout circuit consists of anode drivers Q1 through Q9, amplifiers Q10 through Q18, segment drivers Q101 through Q108, and readout tubes V101 through V103. Amplifiers Q10 through Q18, controlled by the multiplexing (scanning action) of IC1, turn the anode drivers on and off. The anode drivers, in turn, act as electronic switches that turn on and off each digit section of the readout tubes. This results in a continuous switching on and off of each digit at a rate and sequence determined by the multiplexing action of IC1. The multiplexing of IC1 is at a rate fast enough to cause each digit to appear as a steady indication to the eye.

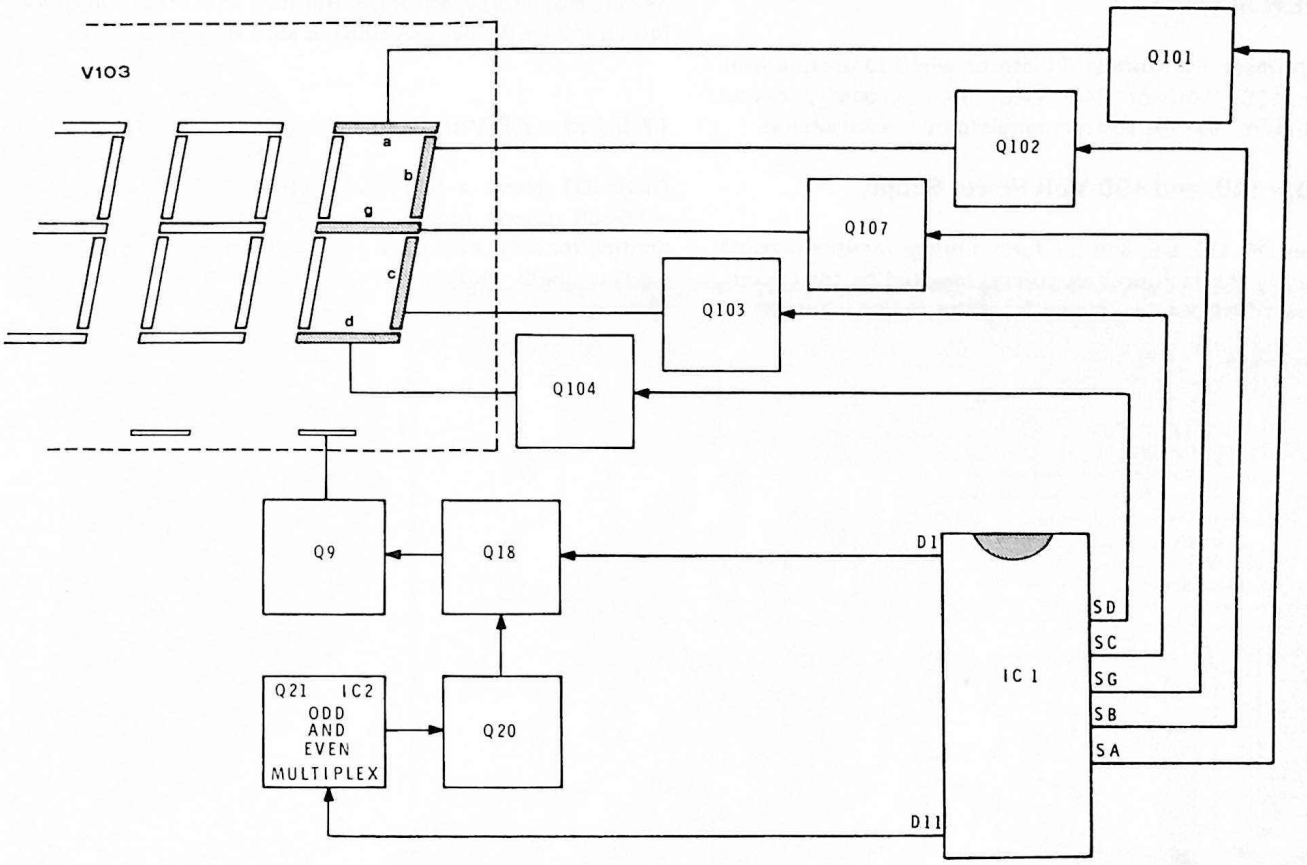
Segment drivers Q101 through Q109 are controlled by the internal circuits of IC1. These drivers apply voltages to the appropriate segments of the readout tubes to form numerical displays.

ODD AND EVEN READOUT BLANKING

The odd and even readout blanking circuit drives the readout display so that no two adjacent digit sections are turned on at the same time. This action prevents stray glowing that might otherwise occur between adjacent digits within the same tube envelope.



ODD AND EVEN MULTIPLEXING
Figure 3-2



TYPICAL READOUT LIGHTING
Figure 3-3

The D11 output of IC1 provides a signal through transistor Q21 to the input of the flip-flop circuit of IC2 (see Figure 3-2). The Q and $\overline{Q}$ outputs of IC2 alternately turn transistors Q19 and Q20 on and off. Notice that transistor Q19 connects to the readout circuits of odd-numbered transistors Q11, Q13, Q15, and Q17; while transistor Q20 connects to the readout circuits of even-numbered transistors Q10, Q12, Q14, Q16, and Q18.

DECIMAL POINT SWITCH

The 10-position Decimal Point switch provides IC1 with the necessary data for either a floating or fixed decimal operation. Positions 0 through 7 are connected to IC1 to select any one of eight fixed decimal point positions. The two F (floating) positions are identical and remain unconnected to allow the decimal point to be automatically placed in the correct location.

TYPICAL READOUT LIGHTING

Figure 3-3 shows the driving circuits required to light the numeral 3 in the last digit section (extreme right-hand position) of V103.

To form the lighted numeral, IC1 supplies a turn-on signal through its SA, SB, SC, SD, and SG outputs. (Notice that these outputs are labeled to stand for Segment A, Segment B, etc.). These signals cause transistors Q101, Q102, Q103, Q104, and Q107 to ground their respective a, b, c, d, and g segments. At the same time, but in multiplex sequence, IC1 supplies a turn-on signal through its D1 output to transistor Q18. When turned on by its normal odd and even multiplex action (controlled by IC2), Q18 allows Q9 to apply a high voltage through pin 9 to the anode of the last digit section in V103. This lights the segments to display the numeral 3.

POWER SUPPLY

Dual-primary transformer T1 can be wired to operate from either 120 VAC or 240 VAC. Two secondary output windings furnish the voltages required by the Calculator.

+230, +140, and +90-Volt Power Supply

Diodes D4, D5, D6, and D7 form a bridge rectifier network to supply the high positive voltage required by the circuits. The rectified output voltage from this bridge is filtered by resistor R61 and capacitor C3. Resistors R62, R63, and R64 form a voltage divider that supplies each voltage value.

+7.5 and −7.5-Volt Power Supply

Diode D1 forms a half-wave rectifier for the +7.5 and −7.5-volt power supply. Resistor R59 provides current limiting for zener diodes D2 and D3. These two zener diodes regulate both output voltages. Capacitor C2 provides filtering.

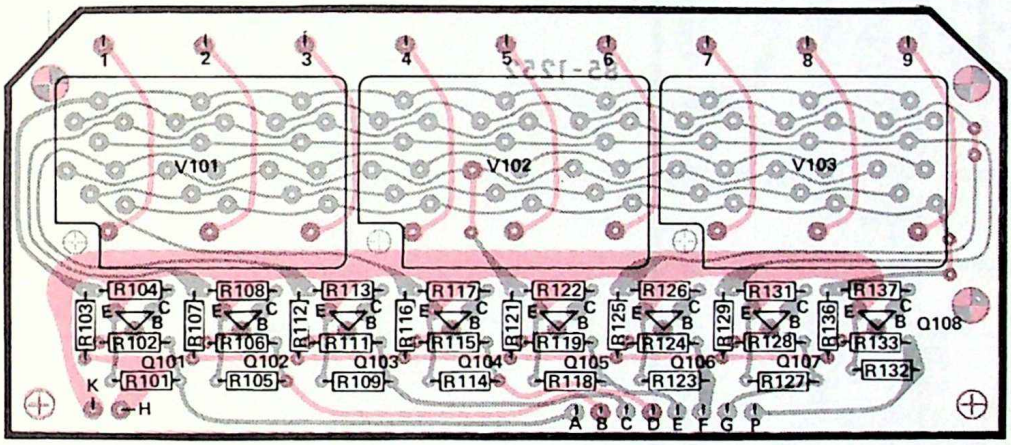
CIRCUIT BOARD X-RAY VIEWS

NOTE: To identify a part shown in one of these Views, so you can order a replacement, proceed as follows:

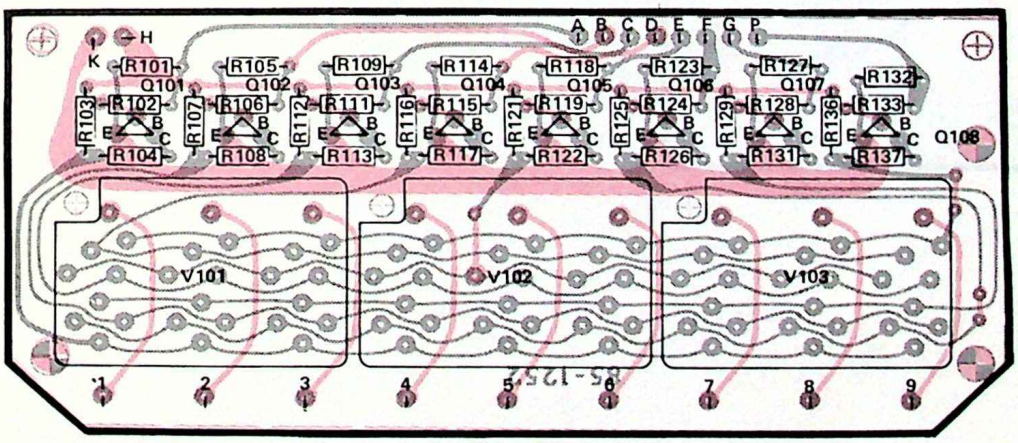
1. Note the identification number of the part (R-number, C-number, etc.).

2. Locate the same identification number (next to the part) on the Schematic. The "Description" of the part (for example: 22 kΩ, .05 μF, or 2N2712) will also appear near the part.

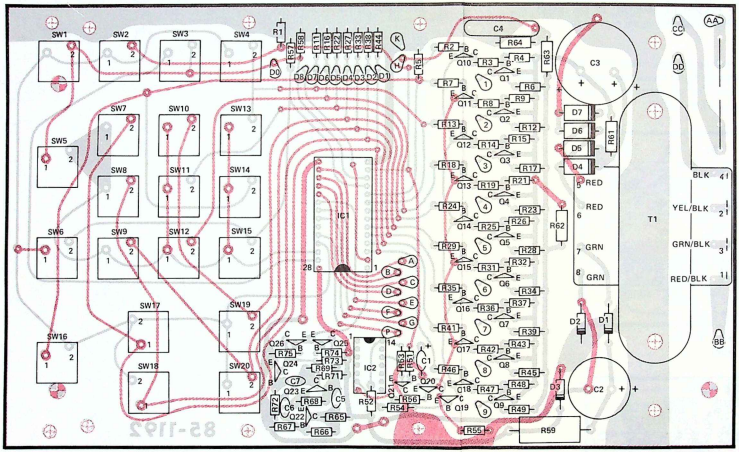
3. Look up this Description in the Parts List. Note that the circuit boards have foil patterns on both sides. The foil pattern on the component side is shown here in RED.



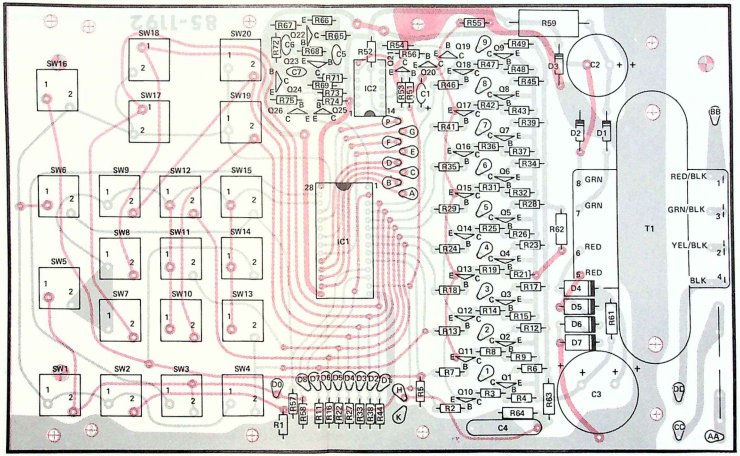
READOUT CIRCUIT BOARD X-RAY VIEW
(Viewed from component side)



READOUT CIRCUIT BOARD
(Viewed from foil side)

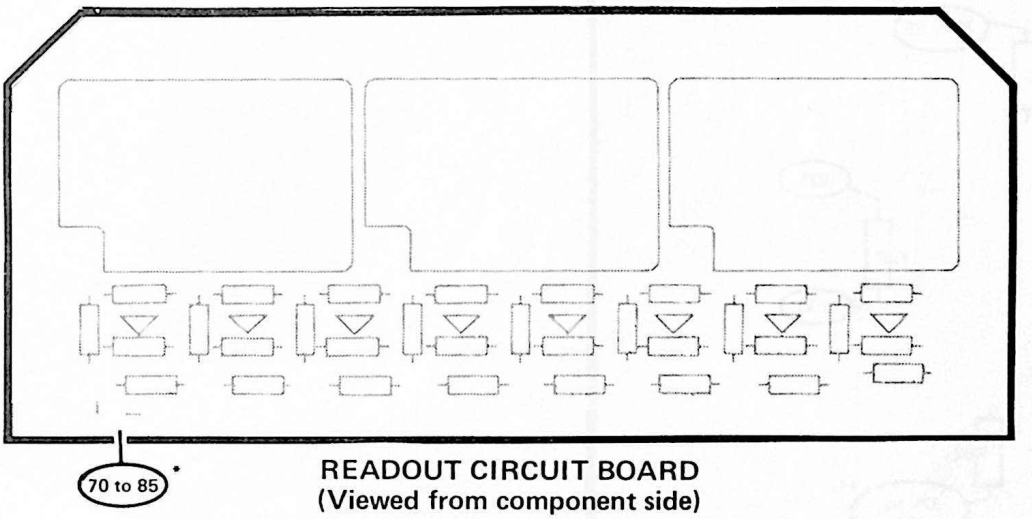


MAIN CIRCUIT BOARD X-RAY VIEW
(Viewed from component side)



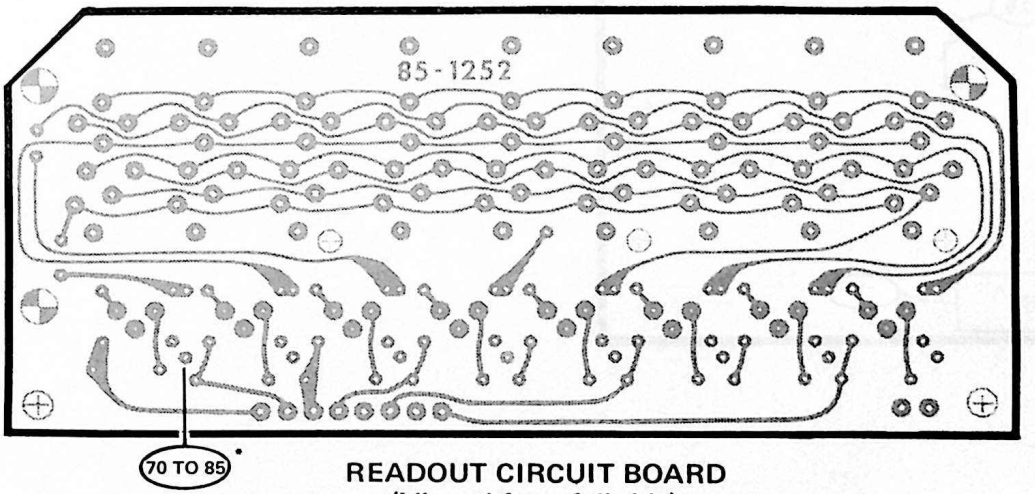
MAIN CIRCUIT BOARD X-RAY VIEW
(Viewed from foil side)

VOLTAGE CHARTS



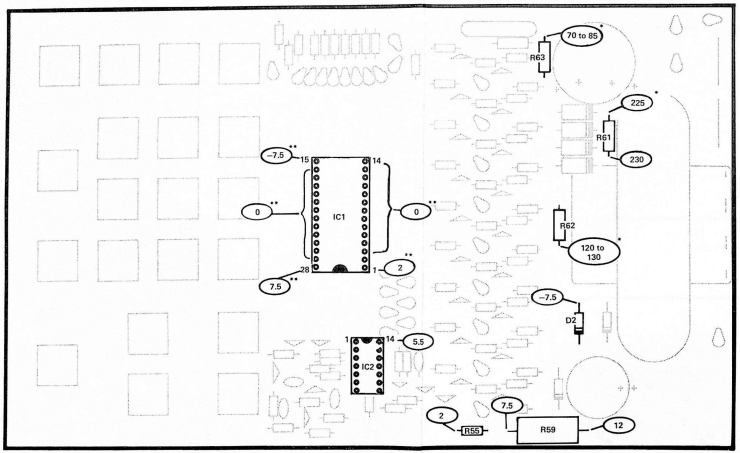
READOUT CIRCUIT BOARD
(Viewed from component side)

*Depends on numerals displayed on readout.



READOUT CIRCUIT BOARD
(Viewed from foil side)

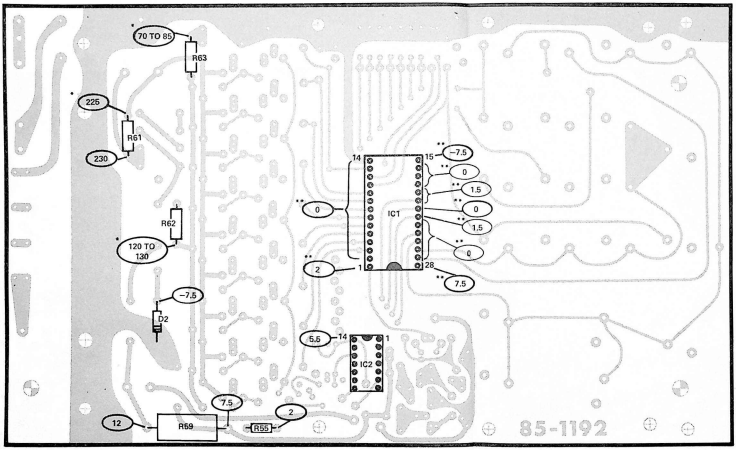
*Depends on numerals displayed on readout.



*Depends on numerals displayed on readout.

**Remove IC1 before measuring these voltages.

MAIN CIRCUIT BOARD
(Viewed from component side)

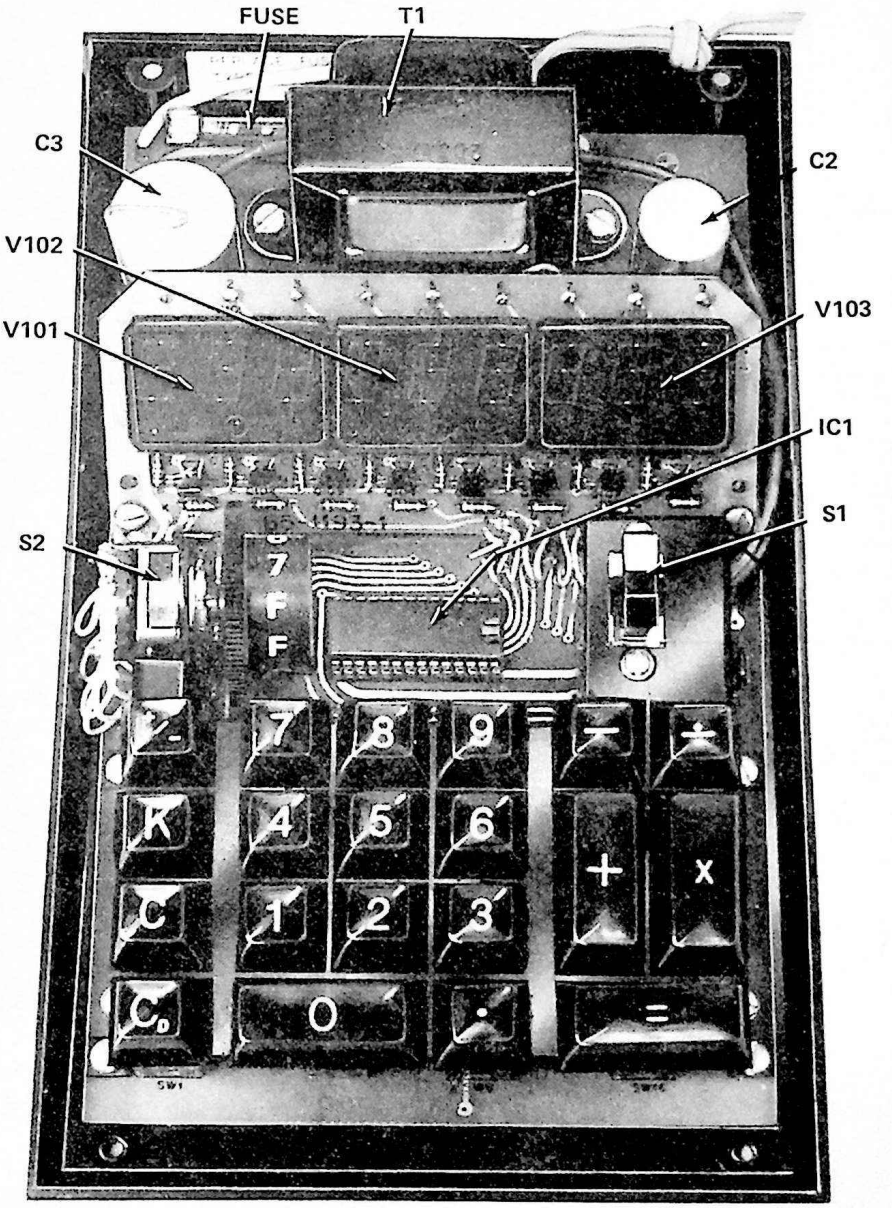


*Depends on numerals displayed on readout.

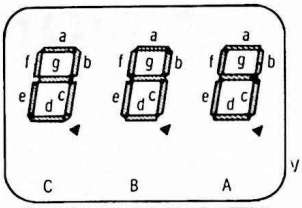
**Remove IC1 before measuring these voltages.

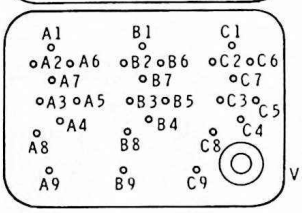
MAIN CIRCUIT BOARD
(Viewed from foil side)

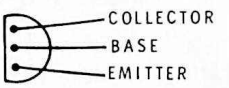
IDENTIFICATION PHOTOGRAPH

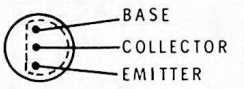


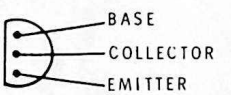
Semiconductor Identification Chart

<table>
<tr><th>COMPONENT</th><th>HEATH PART NUMBER</th><th>MAY BE REPLACED WITH</th><th>IDENTIFICATION</th></tr>
<tr><td>V1, V2, V3</td><td>411-281</td><td>SPERRY RAND SP-753</td><td>


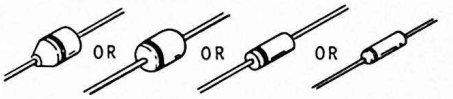
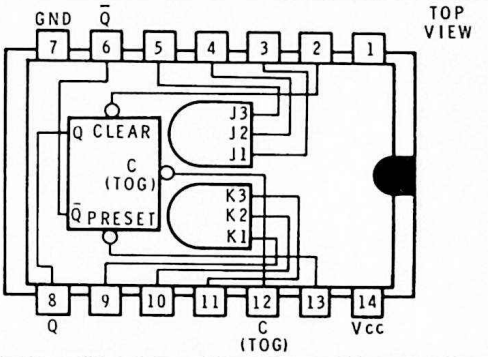
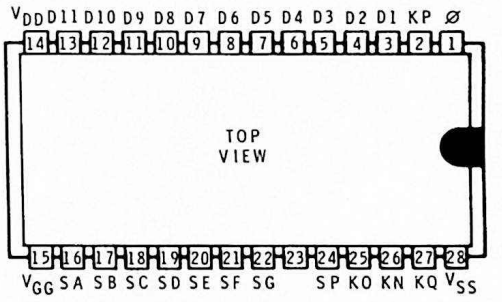
VIEWED FROM FRONT


VIEWED FROM BACK
<table>
<tr><th>SEGMENT</th><th>PIN NUMBER</th></tr>
<tr><td>a</td><td>1</td></tr>
<tr><td>b</td><td>2</td></tr>
<tr><td>c</td><td>3</td></tr>
<tr><td>d</td><td>4</td></tr>
<tr><td>e</td><td>5</td></tr>
<tr><td>f</td><td>6</td></tr>
<tr><td>g</td><td>7</td></tr>
<tr><td>DECIMAL</td><td>8</td></tr>
<tr><td>ANODE</td><td>9</td></tr>
</table>
</td></tr>
<tr><td>Q10-Q20, Q101-Q108</td><td>417-294</td><td>MPS-A42</td><td rowspan="2">


(BOTTOM VIEW)</td></tr>
<tr><td>Q1-Q9</td><td>417-295</td><td>MPS-L51</td></tr>
<tr><td>Q21-Q25</td><td>417-118</td><td>2N3393</td><td rowspan="2">




(BOTTOM VIEW)</td></tr>
<tr><td>Q26-Q27</td><td>417-201</td><td>X29A829</td></tr>
</table>

COMPONENT	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
D1	57-65	1N4002 SILICON DIODE, 1A, 100V.	NOTE: HEATH PART NUMBERS ARE STAMPED ON MOST DIODES. 
D2, D3	56-97	1N3017 ZENER DIODE, 7.5V, 34mA.	
D4, D5, D6, D7	57-27	1N2071 SILICON DIODE, 1A, 600V.	
IC2	443-4	SN7472N	
IC1	443-88	TMS1875	

SCHEMATIC OF THE HEATHKIT® ELECTRONIC DESK-TOP CALCULATOR MODEL IC-2008

NOTES:

1. ALL RESISTORS ARE 1/8 WATT UNLESS MARKED OTHERWISE. RESISTOR VALUES ARE IN OHMS (K=1,000 M=1,000,000).
2. ALL RESISTORS ARE 10% UNLESS MARKED OTHERWISE.
3. ALL CAPACITOR VALUES ARE IN μf UNLESS MARKED OTHERWISE.
4. REFER TO THE CHASSIS PHOTOGRAPHS AND CIRCUIT BOARD X-RAY VIEWS FOR THE PHYSICAL LOCATION OF PARTS.
5. ▽ THIS SYMBOL INDICATES A CIRCUIT BOARD GROUND.
6. □ THIS SYMBOL INDICATES A NUMBERED OR LETTERED CIRCUIT BOARD CONNECTION.
7. ⬭ THIS SYMBOL INDICATES A DC VOLTAGE TAKEN WITH A HIGH IMPEDANCE INPUT VOLTMETER FROM THE POINT INDICATED TO GROUND. VOLTAGES MAY VARY ±10%.
8. * THIS SYMBOL INDICATES THAT A VOLTAGE DEPENDS ON THE NUMBER OF NUMERALS DISPLAYED ON THE READOUT.
9. ** THIS SYMBOL INDICATES THAT A VOLTAGE SHOULD ONLY BE MEASURED WITH IC1 REMOVED FROM THE CIRCUIT.
10. ⟶ THIS SYMBOL INDICATES A VOLTAGE SUPPLY CONNECTION.
11. ⬤ THIS SYMBOL INDICATES A LETTERED TEST POINT.
12. ⬬ THIS SYMBOL INDICATES A PART NOT MOUNTED DIRECTLY ON A CIRCUIT BOARD.

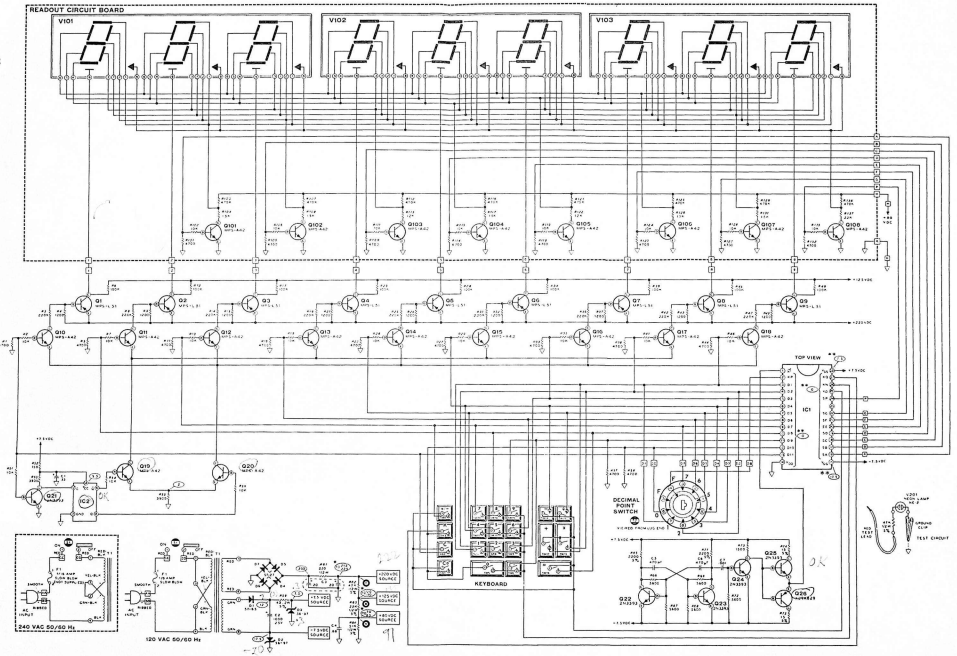
WAVEFORMS:

SHOWN BELOW ARE THE APPROXIMATE VOLTAGE WAVEFORMS TAKEN AT THE POINTS INDICATED WITH A DUMONT OSCILLOSCOPE (INPUT DIVIDER). OSCILLOSCOPE ALL VALUES ARE APPROXIMATE

PIN 9 OF V101, V102, AND V103.

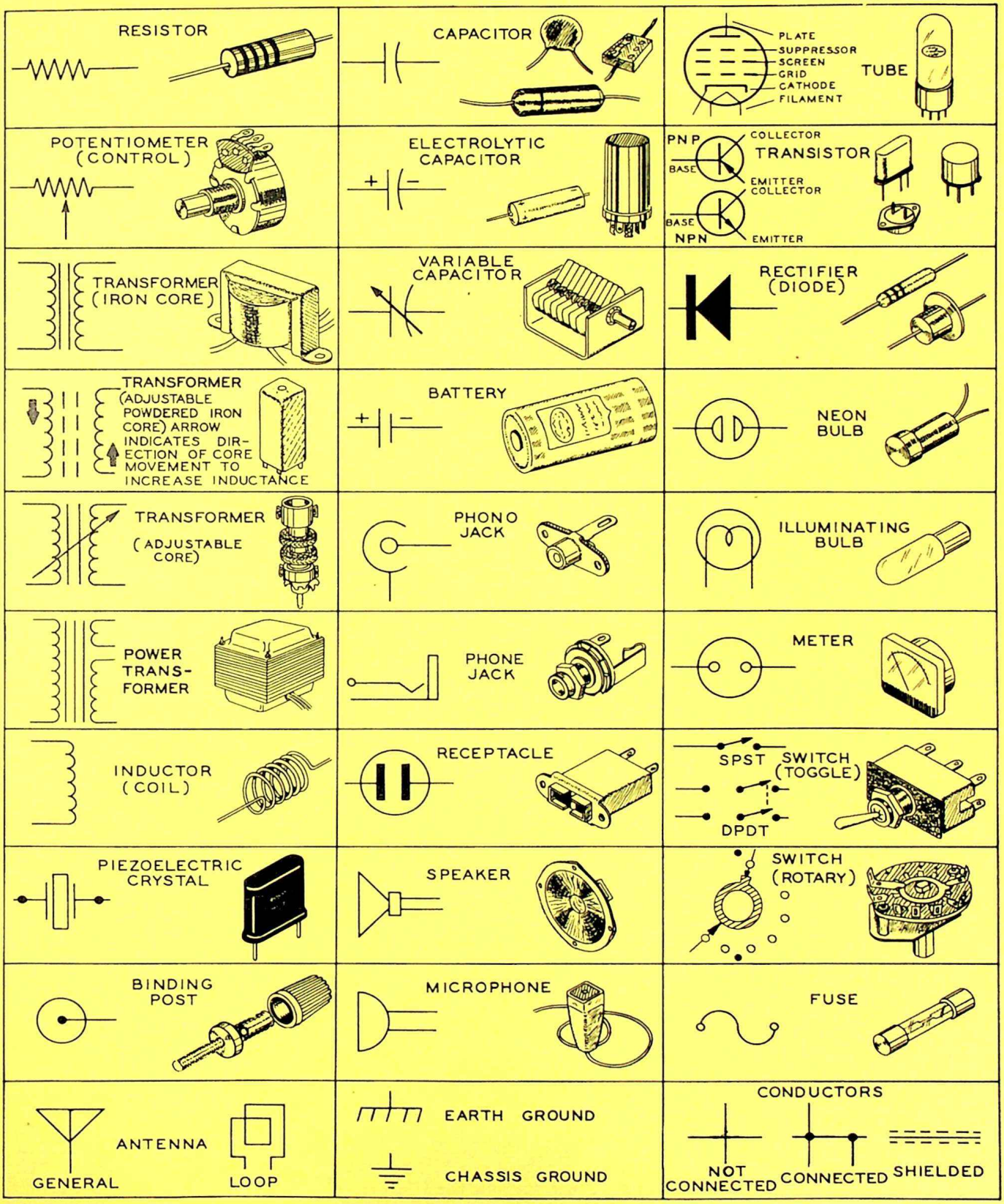
PIN 1 OF IC1

PINS 3–13 OF IC1



TYPICAL COMPONENT TYPES

This chart is a guide to commonly used types of electronic components. The symbols and related illustrations should prove helpful in identifying most parts and reading the schematic diagrams.



HEATH COMPANY

BENTON HARBOR, MICHIGAN

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

LITHO IN U.S.A.